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PRACTICAL WINERY & VINEYARD

JANUARY/FEBRUARY 2002

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Laboratory testing for grapevine diseases

VARIETAL REVIEW
Fine-tuning Syrah

SUPPLIER SHOWCASE
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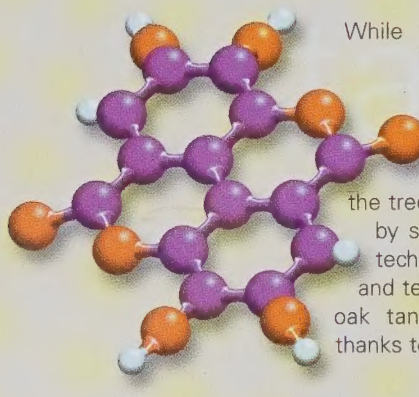
SMART VITICULTURE
Spanish varieties the next trend

Sustainable viticulture in Switzerland

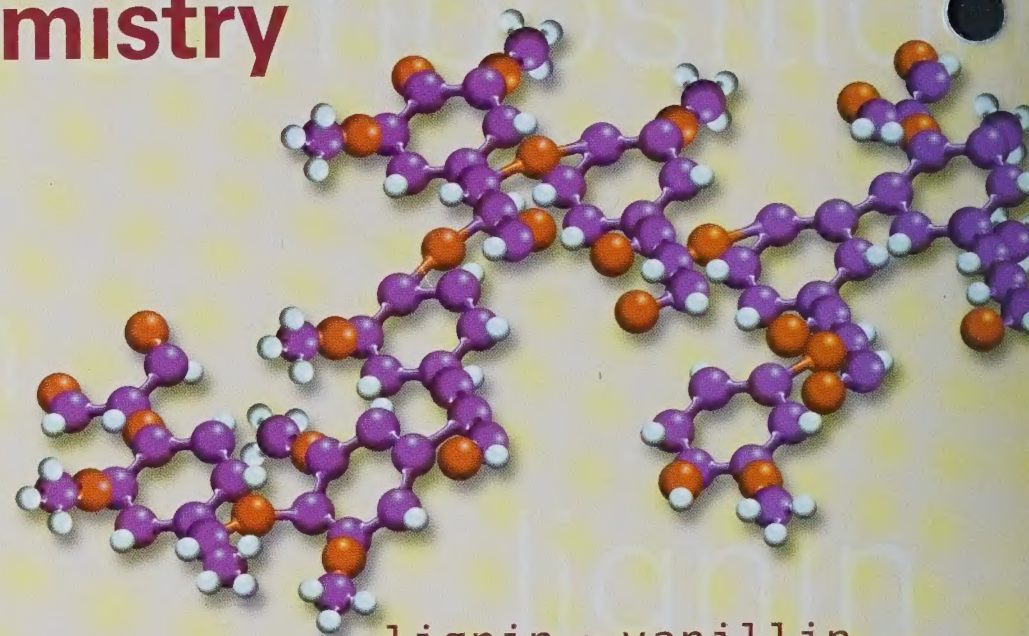
The **composition** of **oak** and its flavor **chemistry**

Part 1 of a continuing oak **education** series



tannin

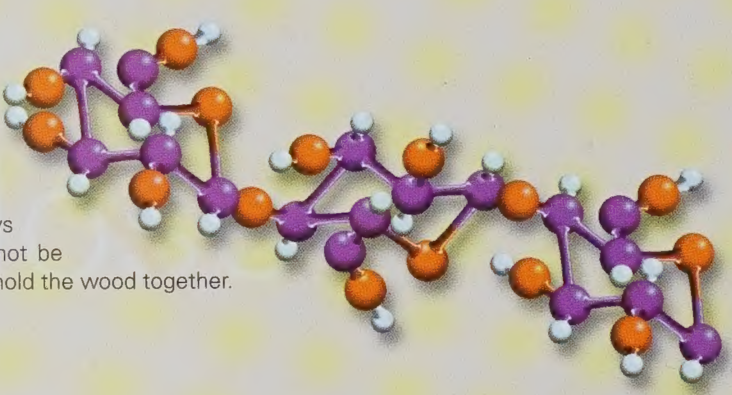
While tannins are approximately 1% of American oak and 8% of French oak mass, they play a vital role in aging. Hydrolysable, heat sensitive tannins stored in the tree's radial rays are controlled by seasoning regimes, bending techniques, plus toasting times and temperatures. Today, precise oak tannin levels are achievable thanks to science.



lignin → vanillin

A family of compounds, notably vanillin, is released during oak lignin breakdown. Slowly, nature's elements including precipitation, ultraviolet rays, and fungi break down lignin while toasting accelerates the degradation. Scientific understanding of these processes allows for more precise flavors.

cellulose



The most abundant, natural polymer on Earth, cellulose is nearly 50% of white oak, but plays only a small part in aging. It cannot be ignored; however, for its ability to hold the wood together.

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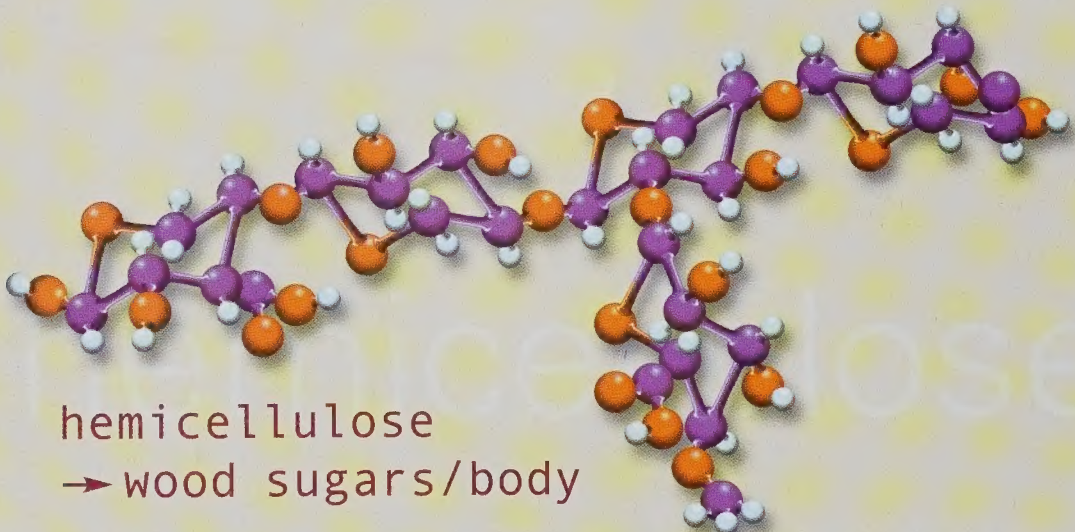

hemicellulose → wood sugars/body

Air seasoning initiates the polymer's break down into simple sugars. As oak climbs through 300°F during toasting, more simple sugars form, then caramelized sugars and sweet-associated aromas develop. Toasty characters develop as the oak passes 420°F. Embracing this research, controlling temperature over time allows definable, repeatable flavors.

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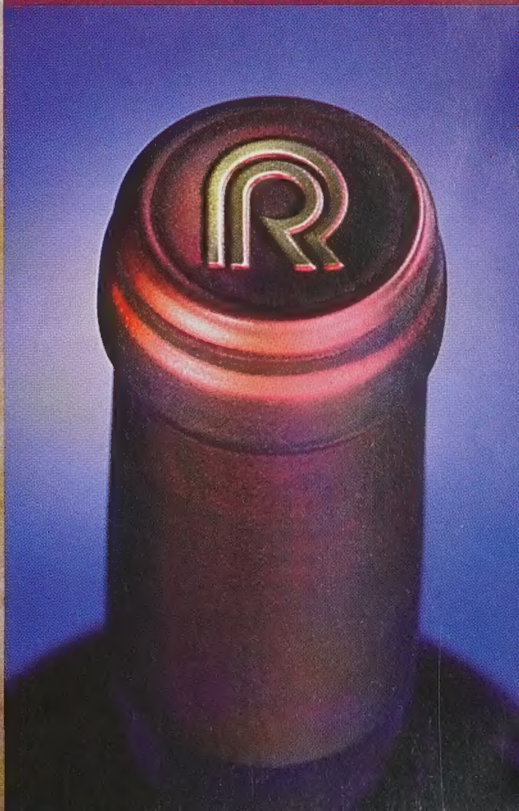

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"To stimulate continuing improvement in the wine industry."

INTEGRITY AWARD

Mondavi reaps industry honor

BY Carol Caldwell-Ewart, Senior Editor

"The greatest leaders don't rule. They inspire," says Robert Mondavi in *Harvests of Joy*, his book about his life in the California wine industry. That philosophy is clearly the heart of why Mondavi was selected to receive the 2001 Wine Industry Integrity Award from the Lodi-Woodbridge Winegrape Commission (LWWC).

Industry notables met in Lodi, CA, in November to honor Mondavi and present the award, reportedly on the very spot where he attended high school as a youth. They recognized Mondavi for the passion and clarity of his vision for the wine industry and for his dedication to bringing it to fruition; for his personal integrity, exemplified throughout the Mondavi organization; and for his innovative approach and unswerving commitment to producing the highest quality wine possible.

The Integrity Award was created by the LWWC in 1998 to "shine the spotlight on individuals whose careers exemplify integrity and provide inspiration for the industry to emulate."

Previous award recipients include Robert Young of Robert Young Vineyards in Geyserville, CA; Dr. Walter Clore of Washington State University; and Patrick Campbell of Laurel Glen Winery in Sonoma, CA.

"Many of us date the new era in fine winemaking in California to 1966, when Robert Mondavi built Robert Mondavi Winery (RMW), the first new winery in Napa Valley since well before Prohibition," says Michaela Rodeno, CEO of St. Supery Winery, (Rutherford, CA), and a member of the Integrity Award selection committee. "He has not deviated since then from his self-appointed mission to establish California wines among the world's best."

"The California wine industry is very fortunate to have a person like Robert Mondavi," declares Randall Lange of Lange Twins in Lodi, CA. "Many years ago, Bob put together a video of his vision, and he shared it with anyone who wanted it. He used it to promote fine wine, fine food, the arts, and moderation, and he promoted that vision wherever he went, until people started buying into it.

Peers call Robert Mondavi a man of vision.

"Mondavi's vision is a guide, and his willingness to share his vision and to let other people have ownership in it and practice it will protect the core of the industry."

Mondavi's innovations in winery dealings with growers are key to his success and an important element in his vision. Lange Twins was one of the earliest winegrape suppliers to Mondavi's Woodbridge line. "When Bob came to Lodi and bought the winery that became Woodbridge," recalls Lange, "he brought a whirlwind of fresh air.

"In those days we grew grapes, sold them, and waited for the checks. His vision of food and wine brought growers into the winemaking process."

In support of his vision, Mondavi created the Quality Enhancement Team and offered "meaningful, long-term contracts for winegrowers," Lange explains. "Mondavi always kept our lots separate and invited us to taste our wines and provided other wines to compare them to. He inspired us to bring in the best grapes we possibly could.

"I think he brought the evolution from commodity grower to winegrower. His vision has had a profound effect on growers and has inspired other wineries to follow that lead at every price point."

Dana Merrill, president of Mesa Vineyard Management (Templeton, CA), says his firm has managed the vineyard operation at Mondavi's Byron Estate in Santa Barbara County since 1989, in addition to selling

Mondavi grapes from other owned or managed properties on the Central Coast. "Robert Mondavi exemplifies the best of our industry," Merrill says.

"He saw early on that growers and wineries must work together to improve wine quality and advance our industry," continues Merrill. "His efforts contributed to a new era of cooperation between wineries and growers. While I was chairman of the California Association of Winegrape Growers (CAWG), for example, the Mondavi organization worked extensively with us to promote sustainable farming, the Pierce's Disease Assessment, and other measures that help both growers and wineries.

"Robert Mondavi's innovation, in winemaking techniques and in moving into the vineyard to enhance wine quality, has laid the cornerstone for our industry's success today."

George Hendry at Hendry Ranch in Napa Valley has been selling grapes to RMW since 1985. "Robert Mondavi's organization has been instrumental in the work we do in our vineyard and our winery. They work very closely with growers, offering them technical advice, encouragement, and information. They tell you when your wine is very good.

"After several years of good report cards, we decided to make wine too. When we have problems with our winemaking, we go to the people at Mondavi and they help. Mr. Mondavi recognizes that being open and sharing with other people in the business actually benefits Mondavi by benefitting the industry as a whole."

Zelma Long worked for Robert Mondavi Winery in Oakville, CA, from 1970 through 1979; most of that time, she was chief enologist. Today she is owner of Zelphi Wines, ZL Wine Consulting in Healdsburg, and part-owner of Long Vineyards in Napa Valley. On a personal note, she says, "It's easy to speak of Robert Mondavi's achievements, they are numerous and visible. But as a person of integrity… [he has] many qualities to appreciate and emulate."

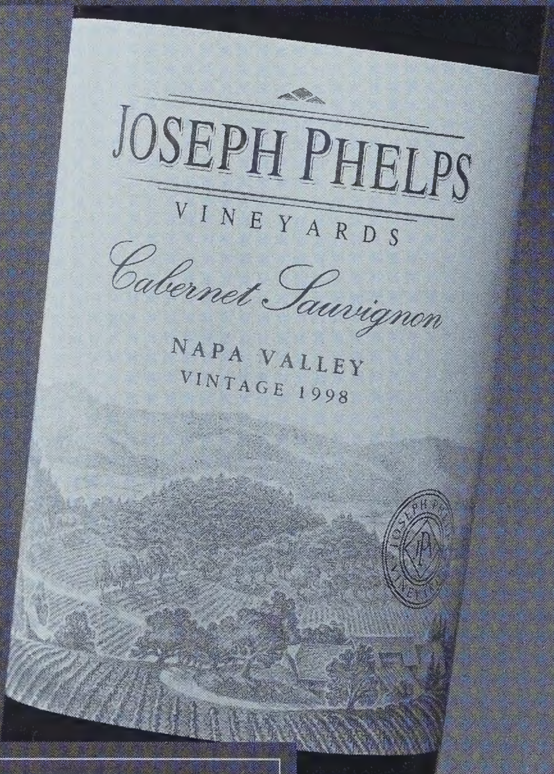
Long describes Mondavi as open: "There are no hidden agendas with Bob;" generous: "RMW was the original winery incubator before anyone knew what a business incubator was;" curious and enthusiastic: "We made wine with 'what ifs' — what if we did this, got the grapes from there, blended with the other, tried that new piece of equipment, new yeast, new technique? Bob was the king of new ideas;" and positive: "It was fun to work in an atmosphere of always doing more and better; of having Bob expect that you **could** do it, of setting excellence as a goal; of getting resources to help accomplish it."

Merrill describes Mondavi as a "rare individual who combines a charismatic appeal, infectious optimism, and strong determination with a good business sense. The Mondavi companies would not be where they are today without his ability to build a management team that can carry his vision to new heights."

John Ledbetter, partner at Vino Farms, farms in Lodi, as well as California's North Coast, Central Coast, and the Delta. "Our operation has had contracts with Mondavi in Lodi since 1978. We do business with 35 wineries in California, and the relationship with the Mondavi organization is one of our best. From day one, their dealings have been above board, honest, forthright, and with integrity.

"Robert Mondavi is the ambassador for wine in the U.S. He and his organization are also respected world-wide. They are a leader in quality and one of the premier marketers of wine in the world. Look at how they're building relationships with quality wineries outside the U.S., and you see that they are really one of the leaders in the U.S. in that area. Besides his position in the world, Robert Mondavi is just a nice man."

PWV congratulates Robert Mondavi on receiving the Integrity Award. ■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Improving winery lab performance

BY Christian Butzke
Associate Specialist in Cooperative Education, UC Davis

Imagine a world where all winemakers can sleep soundly at night and the winery lab staff feels appreciated. Also where consumers can rest assured that all wines are stable and healthy and show the finest qualities of fruit and style. Then wake up, smell the barrels, and realize that only a small number of winery labs in and outside California have lab quality systems in place that would allow for such peace of mind.

That is why the Winery Laboratory Proficiency Testing Guidance Subcommittee of the American Society of Enology & Viticulture (ASEV) established a continuous interlaboratory proficiency testing program for the American wine industry in late 1999. The subcommittee's work, under the guidance of ASEV's Technical Projects Committee, represents the first practical cornerstone of a lab quality system for American wineries.

The concept of proficiency testing was outlined by Sue Weeks in her *Winery Laboratory Quality* column, "Proficiency testing — Support groups for laboratories," (*PWV* May/June 2001). The ASEV program is guided by the subcommittee and managed by Chris Czyryca of Collaborative Testing Services [http://www.cts-interlab.com], who prepares statistical summary reports for the participants.

It is important to point out that participation in a proficiency testing program alone does not automatically lead to better lab performance. Below, we review the reasoning behind such a program, discuss the current state of proficiency in winery labs, and contemplate where we might go from here.

From a vintner's viewpoint, interpretation of the test results is up to each of us, as we aim to establish performance criteria for basic wine analyses and, consequently, our winery labs.

Why should your winery participate?

Whether your winery bottles millions of cases and has a team of enologists and lab technicians available, or you grow the grapes, make the wine, and measure volatile acidity personally to make 100 cases, the criteria for sound winemaking practices are essentially the same.

In addition, regulatory requirements and liabilities for selling your wine will become more and more uniform for all marketplaces, whether you export your wine to the United Kingdom or sell it out of your own tasting room.

Adopting ISO standards Euro-conspiracy, government plot, or a quality issue?

Now that the U.S. delegation has pulled out of the Old World-biased OIV (Office International de la Vigne et du Vin), it is even more important that our wine industry closely observes international competition and stays ahead of the curve when it comes to ensuring the quality and integrity of American wines.

In a time of increasing wine imports, stagnant wine exports, flat overall consumption, and a still looming worldwide economic recession, it can be a costly mistake to ignore trends that bring global competitiveness to a local level.

Quality systems, ISO accreditation, performance criteria — all this lingo sounds like some sort of paper-pushing regulator's idea of fun, generating more paperwork and less time available to get the actual job done.

But in truth, these terms stand for processes that should lead you and your *entire* winery staff to take a step back and remember the most important task of your winery: making wine of the highest quality. That is where the international standards for quality management of analytical laboratories (ISO 17025) come in handy, as they outline a ready-made lab quality system that all wineries can use to their advantage.

To make things even easier for you, ASEV, through its Technical Projects Committee, has produced a *Winery Quality Systems* CD-ROM that is available to all members at cost [society@asev.org]. The multimedia CD highlights the principles of lab quality management, including practical winery examples.

The CD can help staff at wineries of all sizes understand and implement an internationally accepted quality system appropriate for their own environment. The goal may range from implementing the first basic steps to full ISO accreditation. The latter is already required in some export markets and is being quickly adopted and implemented by all our relevant government agencies, including BATF, FDA, USDA, U.S. Customs Service, and others.

Five basic steps to a Quality System

Following are the essential steps required to initiate a lab quality system at your winery:

1. Preparation of a **Quality Manual** that details the agreement between senior winery management, winemakers, and the laboratory regarding the quality and performance goals of the laboratory and the resources (equipment, staff, etc.) required to meet those goals.

2. **Method validation** constitutes another important first step. Often, a winery laboratory inherits methods or adopts them because they exist in a publication.

ISO emphasizes that a method is valid only after its performance has been demonstrated to be adequate for your specific winery laboratory, utilizing your staff and equipment. Furthermore, fully validated methods make it possible to educate winemakers about the performance limitations of individual methods of analysis. See Sue Weeks' column "Method validation — Making sure it works in your laboratory," (*PWV* September/October 2000:76-77) for details.

3. **Documentation of lab procedures** must be done in a consistent format. This is necessary for uniform implementation of individual methods of analysis, and is essential to the generation of quality data.

4. **Training for new and existing staff** is available through courses at independent labs, community colleges, or UC Davis extension classes. You can even do it within your winery using your documented set of lab procedures.

5. **Proficiency testing** is the last piece of the quality puzzle. Internal proficiency testing against standards and control samples verifies ongoing caliber of performance, while external proficiency testing, such as ASEV's program, measures the performance of the winery laboratory against industry peers.

No worries, mates!

Advances in the Australian wine industry over the past 20 years were not due to luck, but to enormous investments in winegrowing and winemaking technology, wine research, and extension programs. One of Australia's successful techniques for optimizing wine quality while improving cost and production efficiency was to establish the Interwinery Analysis Group and lab proficiency testing scheme in 1983.

Almost 20 years behind its closest global competitor, the American wine industry is only now on the right track to make up for this competitive disadvantage. However, if the speed of California's advances in wine quality are any indication, it shouldn't take long for our wineries to catch up.

Preharvest Wine and Grape Quality Air and Road Show

One of the Proficiency Testing Guidance Committee's methods to promote the concept of winery lab quality has been an annual statewide road show, based on the Australian model and introduced by the Australian Wine Research Institute and other extension groups.

In the first Preharvest Wine and Grape Quality Air and Road Show, Gordon Burns of ETS Laboratories, Patricia Howe (teaching lab manager at UCD Dept of Viticulture & Enology), Sue Weeks of Bibber International, and I traveled to the North Coast, the Sierra Foothills, and the Central Coast in August 2001.

The program provided an effective platform for conveying the general concepts of a lab quality management

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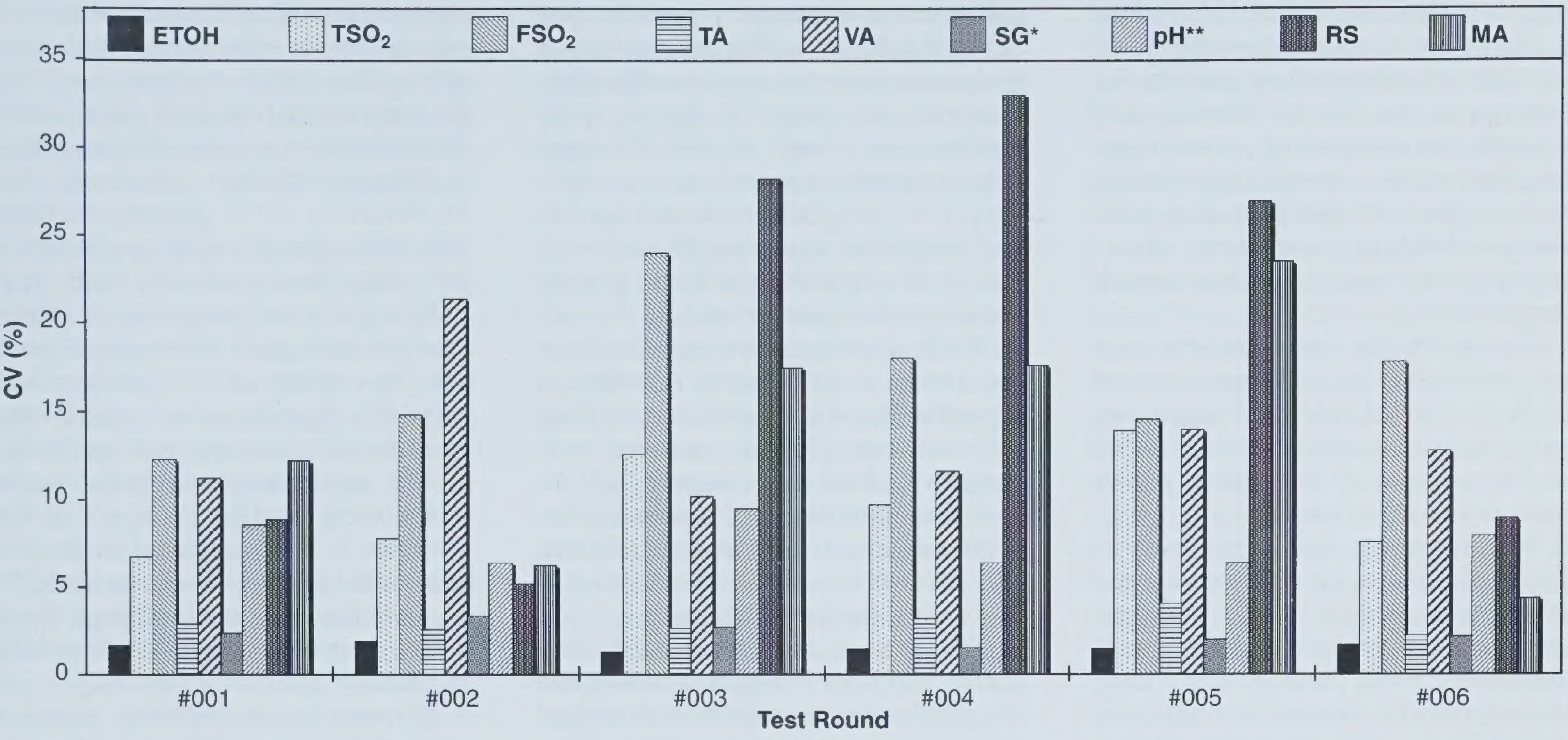
Fig. 1: Relative error (coefficient of variation) by wine analysis between labs



* CV based on a 0.045 kg/L maximum range in commercial table wines

** Coefficient of variation based on logarithmic between-lab standard deviation

system and included small group discussions of particular analysis problems. In addition, the committee organized Winery Interlab Group meetings to present and discuss test results during the Unified Symposium and the 2001 ASEV Annual Meeting.

The Proficiency Testing Guidance Committee plans to continue the road shows just before the 2002 crush, and *PWV* readers are encouraged to suggest class locations that are convenient to reach for most winery lab staff in their counties (e-mail to: cebutzke@ucdavis.edu).

Current state of affairs

So far, there have been six rounds of testing in the ASEV Laboratory Proficiency Testing Program for nine standard wine analyses. Proficiency was tested for analysis of ethanol, total and free sulfur dioxide, titratable acidity, volatile acidity, specific gravity, pH, residual sugar, and malic acid.

Wineries were free to choose their methods of analysis, and the participants remain anonymous. Between 32 and 55 wineries have participated in each round, representing an estimated 90+% of U.S. wine production capacity.

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Test rounds were conducted in February, May, August, and November of each year to minimize interference with lab obligations during crush. For each round, one 750 ml bottle each of two different commercial wines of similar composition were distributed to participating wineries. Each wine came from one bottling run at a large winery to ensure the most consistent sample composition.

Since real wines were tested, the accurate, true values for each measurement are known only to Mother Nature. Any comparison of measurements is based on the averages of the winery participants as a group of peers.

With respect to individual analyses (Figure I), alcohol, specific gravity, and titratable acidity measurements appeared to be precise and were well-correlated among participating winery laboratories. The increased availability of autotitrators may be one reason for improved proficiency in TA.

The coefficients of variation for both sulfite measurements, especially free SO_2, pH, volatile acidity, residual sugar, and malic acid were undesirably high. However, for some of the analyses, results were biased toward the most popular methods of analysis — such as Ripper for total SO_2, Cash still for VA, and enzymatic assays for RS and malic acid — all of which contributed proportionally to the grand mean.

While some results may be suitable for internal production control if reproducible, the range of results even without considering outliers was extensive. This is a concern, as the program participants represent the most advanced labs in the industry, and those that are most interested in improving their performance.

The reasons for the unsatisfactory results need to be investigated further, and all possible sources of error for each method of analysis must be determined, documented, and subsequently minimized.

Below are some statistics and comments on individual measurements; methods are listed in order of reported user frequency. The coefficient of variation (CV) is the error for each analysis relative to the mean of the whole group of winery labs.

Ethanol (EtOH). Methods: 51% Ebulliometer, 31% gas chromatography, 8% near-infrared spectroscopy, 10% distillation/density. Proficiency: Labs were most proficient in alcohol analysis compared to the other analyses. They achieved CVs between 1.2% and 1.8%, despite use of a wide range of equipment and analysis methods.

The application of ebulliometers, which were used by three out of four wineries in 1998, declined in favor of automated assays. Results confirm that non-standardized methodology, if validated, does not compromise the ability to produce acceptable results.

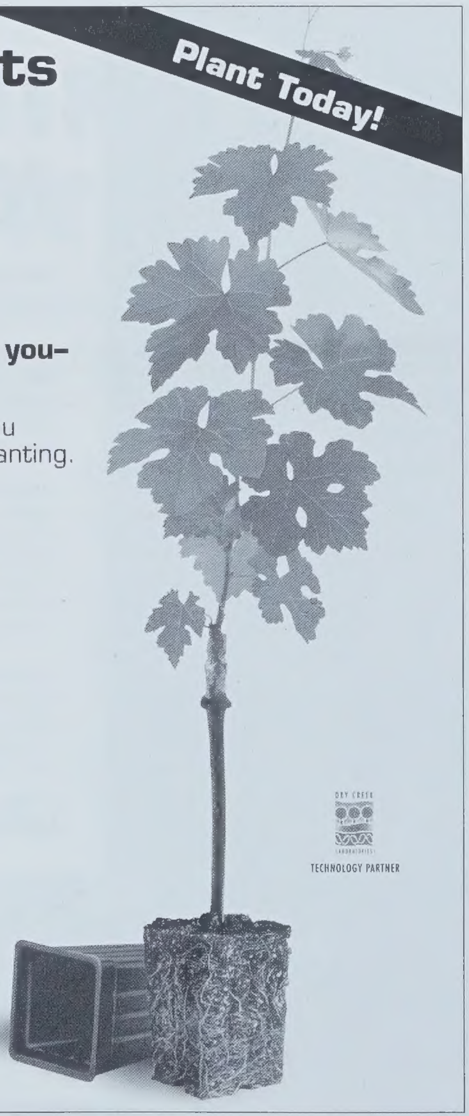
However, the industry trend to make delicate alcohol adjustments to wines for sensory or tax reasons would require an even greater proficiency in order to make such decisions more precise and reproducible.

Total SO_2 (TSO_2). Methods: 68% Ripper, 24% Aeration-Oxidation, 3% enzymatic assay. Proficiency: CVs ranged from 5% to 16% between test rounds. The ratios between concentrations of bound (total minus free) and free SO_2 show a reasonable to generous use of sulfites (52 to 106 mg/L) throughout the winemaking process, with insufficient amounts of free and consequently molecular SO_2 after bottling in three out of four commercial samples tested.

Free SO_2 (FSO_2) Methods: 48% Ripper, 48% Aeration-Oxidation, 4% colorimetric segmented flow analysis. Proficiency: This possibly most important wine analysis regarding microbial stability and general ageability was performed with CVs between 12% and 29%.

The amounts of free SO_2 in the tested wines were between 10 mg/L and 26 mg/L independent of pH. The consequences of additional errors in pH analysis are discussed below. Molecular SO_2 based on wine pH ranged from 0.14mg/L to 0.92 mg/L, suggesting a need for improvements in proper SO_2 adjustments.

Titratable acidity (TA) Methods: 54% manual titration, 46% automatic



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titration. Proficiency: The essential analysis for a wine's perceived tartness improved significantly over the preliminary survey (8%) with CVs between 2% and 4%. This coincided with increased use of autotitrators over manual titration (13%:87% in 1998 to 46%:54% in 2000).

Volatile acidity (VA) Methods: 81% Cash still, 10% enzymatic assay, 3% capillary electrophoresis, 3% gas chromatography, 3% colorimetric segmented flow analysis. Proficiency: The concentration of acetic acid and other volatile acids in wine is a federally regulated wine quality criterion (limits: 0.14 g/100 ml for red, 0.12 g/100 ml for white table wines).

Concentrations of VA in the wines tested were between 0.02 and 0.08 and thus far below those legal limits, implying good winemaking practices. However, the CVs ranged from 7% to 25%, which would make it difficult to confirm compliance in some instances.

Specific gravity (SG) Methods: 59% hydrometer, 35% density meter, 6% pycnometer. Proficiency: CVs were between 1.3% and 4% even if one compares the standard deviation between labs to the maximum range in specific gravity that can be expected in table wine. This assumes a range between 0.970 (14% v/v ethanol, no RS) to 1.015 (9% v/v ethanol, 50 g/L RS) kg/L (20°C / 20°C).

pH Methods: All labs used electronic pH meters. Proficiency: Labs achieved CVs between 6% and 9%, given the logarithmic nature of the pH measurement. This consideration increases the relative errors but recognizes the critical consequences of small inaccuracies in pH on the biological and chemical stability of the wine, especially the amounts of molecular SO_2 available.

The molecular SO_2 concentration for a given free SO_2 content at a particular pH [formula: molecular SO_2 = free SO_2 / $(1+10^{(pH-1.83)})$] determines the microbial stability of a wine. The suggested values have been between 0.6 to 0.8 mg/L (at 14%v/v and 12 %v/v ethanol, respectively) for protection against lactic acid bacteria.

Concentrations below 0.6 mg/L may lead to a potential instability in case of a failure or absence of a sterile filtration step at bottling, especially in wines that have not undergone a complete malolactic fermentation. An 0.1 underestimate of the pH represents a 26% overestimate of actual hydrogen ion concentration, which results in a proportionally higher requirement for free SO_2.

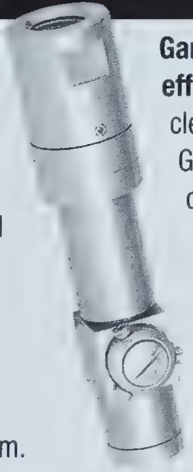
Under commercial winemaking conditions, errors in the analysis of pH and free SO_2 add up because of the impact of the hydrogen ion concentration on the equilibrium of the different ionic forms and the molecular form of sulfur dioxide in an aqueous solution such as wine.

The combined CVs for both analyses were between 19% and 39% for all labs and test rounds. If a wine is considered microbially stable because it is dry and has completed ML, one can be less concerned about the levels of molecular SO_2. However, given the poor performance for both RS and malic acid analyses (see below), no winemaker should rely on those results alone.

Residual sugar (RS) Methods: 69% enzymatic/spectrophotometric assay, 26% copper reduction assays (Gold Coast, Lane-Eynon, etc.), 5% HPLC. Proficiency: The analysis of residual fermentable sugar is crucial to determine microbial stability of a table wine and to adjust its sensory properties for the consumer.

The CVs improved significantly over the preliminary survey (140%), ranging from 5% to 39%. Given the dual importance of the analysis, this still appears to be unacceptable, even considering that some labs from wineries that produce only dry table wines were not accustomed to analyzing wines with relatively high amounts of RS.

The slight improvements may be attributed to an increased use of the enzymatic assay over copper reduction assays (51%:46% to 69%:26%) over the past three years. More important, wineries overcame problems reporting the actual sugars measured and the magnitude of their RS results.



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L-Malic Acid (MA) Methods: 97% enzymatic assay, 3% capillary electrophoresis. Proficiency: Similar to the enzymatic determinations for RS, the CVs of the assay for malic acid varied in a wide range of 4% to 39%. Given the corresponding consequences of uncertainty over incomplete or deliberately prevented malolactic fermentations, in particular, CO_2 evolution in the bottle, and changes in perceived acidity, this performance requires major improvements.

The whole picture

Lab proficiency tests in 2000 and 2001 showed similar levels of proficiency throughout the six test rounds. This was not a surprise, since a proficiency testing program alone is not sufficient to improve a laboratory's analytical proficiency.

As mentioned above, a complete lab quality management system is required to achieve this goal. However, it is positive to note that labs have become more proficient in reporting the units of measurement correctly. Statistical results of the proficiency testing program so far suggest a continuing need for improved laboratory quality management systems.

With the proficiency testing program in place, the ASEV Technical Projects Committee will be able to address remaining parts of the winery lab quality management system, and proficiency surveys will confirm anticipated improvements.

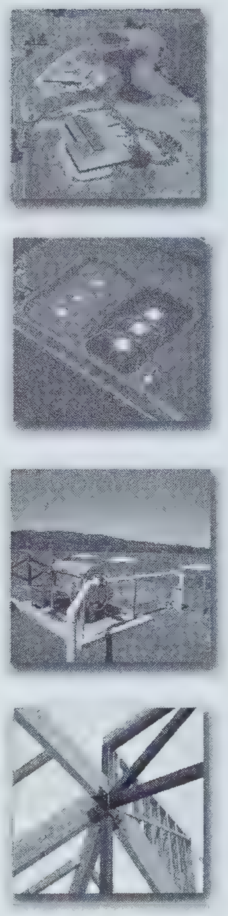
As a next step, wineries need to establish performance criteria for the different analyses of wine that reflect the significance of their accuracy and precision for the quality and stability of any wine.

Performance criteria?

So far, the proficiency testing program has judged lab performance solely by statistical comparisons. Why? Because uniform performance criteria for wine analyses have not yet been established. To make proficiency testing most meaningful, it should be based on wine quality and stability requirements that reflect the sensory, biological, and chemical properties of the wine components analyzed.

As stated in the beginning, when it comes to performance criteria, (winery) size doesn't matter. Every winery lab should be confident in the data it creates, and every winemaker should be able to rely on those data to make production decisions without nagging doubts. We all need to agree on acceptable errors for each of our measurements to assure safe, high quality winemaking practices.

Your input is invited! ■



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UPDATE

Laboratory testing for grapevine diseases

BY Ed Weber, UC Cooperative Extension
Deborah Golino, Director
Foundation Plant Materials Service
Adib Rowhani, Plant Pathologist, FPMS

Laboratory testing for grapevine diseases is useful for diagnosing problems in existing vineyards. Identifying infected propagation wood can help growers avoid spreading diseases to new vineyards.

In the past, detection of viruses in grapevines was largely accomplished by laborious and slow biological tests. Today, many of the most important grapevine viruses can be detected using fast laboratory tests. Although this article will focus on viruses, similar testing is available for diseases caused by fungi or bacteria.

Field diagnosis is challenging

Laboratory testing is a valuable tool when investigating vineyard problems because field diagnosis of grapevine diseases can be difficult. Symptoms displayed in the field are rarely unique to a particular disease. In addition, some infected vines may not show any symptoms indicative of their disease status.

In some cases, grapevine diseases produce distinct symptoms that make them easy to identify in the field. Late spring foliage symptoms of Eutypa, for example, are not likely to be confused with other problems. In this case, laboratory testing would not be necessary to identify the cause of the problem. With considerable experience, several other diseases can be reliably diagnosed based on field symptoms.

More often, a particular set of symptoms could result from a number of causes. Red leaves, for example, could be an indication of a virus disease, a fungal root disease, a nutritional deficiency, physical damage, or feeding by mites, insects, or rodents. Similarly, leaf scorch could be a symptom of Pierce's disease, water stress, sulfur burn, or spray damage. Disease testing is often used to help sort out the true nature of the problem leading to symptom expression.

With most grapevine virus diseases, diagnostic symptoms only occur during certain times of the year. Leafroll, for example, causes leaves to redden in red-fruited varieties in the late summer and fall. Examination of these vines in the spring would give no indication of their disease status.

It is virtually impossible to diagnose grape virus diseases in the field during the dormant season, a time when many growers and nurseries cut wood for propagation.

In addition, grapevines infected with some disease agents (especially viruses) may *never* show any obvious symptoms! The concentration of disease-causing agents may be so low that no disease symptoms develop, or the infection may be in a grape variety that is tolerant to that particular disease.

Such latent infections can only be detected with reliable disease testing methods. This is an important consideration when collecting wood for propagating new vines, since virus diseases that may not be evident on one rootstock, or in certain growing conditions, may cause severe disease when infected wood is grafted to create new vines.

Testing methods

Several methods of disease testing are available from commercial plant pathology laboratories (see Table I). These include direct culture of disease agents; serological tests, such as ELISA; and molecular tests, such as Polymerase Chain Reaction (PCR). Other types of tests, such as indexing with biological indicators, are usually performed only at research institutions such as the University of California.

ELISA plate being loaded with virus antibody in preparation for grapevine sample analysis.

Table I — Disease testing services

Lab	Indexing	ELISA	PCR	Phone	Website or Email
AgDia	No	Yes	Yes	800-622-4342	www.agdia.com
Agri-Analysis	No	Yes	Yes	530-757-4656	www.agri-analysis.com
California Seed & Plant Lab	No	Yes	Yes	916-655-1581	www.calspl.com
Foundation Plant Materials Service	Yes	Yes	Yes	530-752-3590	http://fpms.ucdavis.edu
STA Laboratories	No	Yes	No	408-846-9964	www.stalabs.com
Waite Diagnostics	No	No	Yes	618-8303-7426 Australia	http://planta.waite.adelaide.edu.au/waite_diag.hhtm

Direct culture of plant pathogens

Direct culture is the oldest form of laboratory testing and is still commonly used to help identify many fungal and bacterial disease agents. This method involves placing samples of diseased tissue onto selective culture media and observing what organisms grow. Certain types of selective media only allow fungi to grow, while others only allow bacteria to grow.

Several media recipes have been designed so that only certain fungi or bacteria will grow. The use of these selective media, along with microscopic observation (or other diagnostic testing) of the organisms that do grow, helps confirm the cause of many diseases.

In grapes, culture methods are commonly used for many fungal diseases, such as Eutypa, Armillaria (oak root fungus), Phytophthora (crown rot), Phomopsis, and Botrytis, as well as bacterial diseases, such as crown gall and Pierce's disease. Viruses cannot be detected through culture methods.

In order to successfully culture a disease agent, it must be living in the sample provided to the lab. Ideally, samples should include active lesions or interfaces between live and dead

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Table II — Guidelines for sampling and disease testing

Disease	When to test	Tissue to sample	ELISA	PCR
Fanleaf, yellow vein (and other nepoviruses)	Spring is best; fall and winter are okay	Active shoot tips in spring; shoots/canes for cambium scrapings in fall and winter	Reliable in spring	Reliable in spring, less reliable in fall and winter
Leafroll*	Late summer, fall, and winter	Petioles in late summer and fall; shoots/canes for cambium scrapings in fall and winter	Reliable in late summer and fall	Reliable in late summer, fall, and winter
Rupestris Stem Pitting	Year round	Petioles, leaves, or cambial scrapings	Not available	Reliable
Vitiviruses	Spring, fall, and winter	Petioles, leaves, or cambial scrapings	GVA only; most reliable in spring	GVA, GVB, GVD
Fleck	Spring, fall, and winter	Shoot tips and young leaves in spring; shoots/canes for cambium scrapings in fall and winter	Reliable in spring	Reliable in spring, fall, and winter
Pierce's disease	Late summer and fall	Symptomatic leaves and shoots	Reliable in late summer and fall	Reliable in late summer and fall

*ELISA is available for GLRaVs 1 to 5 and PCR test for GLRaVs 1 to 5 and 7.

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- PCR test for Eutypa
- Culture tests for young vine decline
- PCR test for crown gall
- Virus elimination by meristem culture
- Rootstock & variety ID by SSR markers

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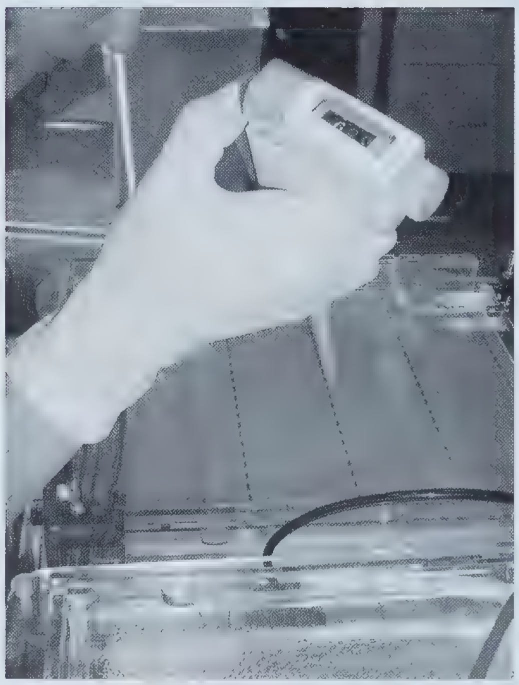


In the PCR test, grape pathogens are identified from characteristic banding patterns formed on a agarose gel.

tissue. Collecting dry leaves or dead stems will be of no value towards culturing.

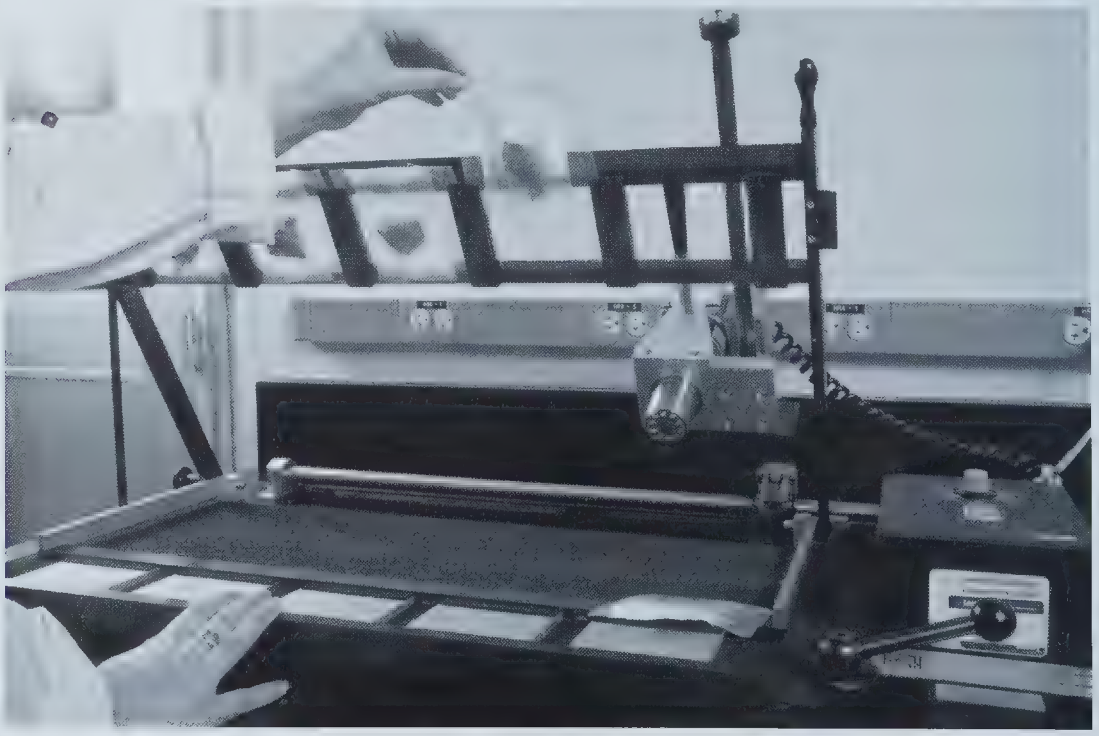
Culturing is a slow, labor-intensive practice. Also, considerable expertise is needed to reliably identify organisms that grow on the plates. Check with a plant pathology laboratory to see what types of culture services they provide.

Serological tests — ELISA

Serological methods utilize antibody reactions with disease agents, usually viruses or bacteria. Antiserum is produced by first injecting an animal (typically a rabbit) with a purified preparation of a plant pathogen, such as a virus. The animal reacts to this foreign material by producing antibodies. These antibodies react specifically with the pathogen that was used to create them. The antibodies are then purified from blood serum and the resulting antiserum is used in diagnostic tests. The most commonly used serological test is Enzyme-Linked Immunosorbent Assay (ELISA).

Many laboratories offer ELISA tests for grapevine diseases caused by viruses and bacteria. ELISA tests are fairly simple to run and can provide results in just one or two days. For ELISA to be successful, antiserum for each disease agent must be available in the lab, and grapevine test samples must come from the appropriate tissue, at the right time of year, and be in good physical condition.

One limitation to ELISA testing is that antisera have not been produced for all grapevine viruses. Therefore, a vine could be infected with a particular virus, but if no antiserum against that virus exists, ELISA will be unable



To prepare a grapevine sample for testing, sample material and buffer solution are sealed in plastic bags and loaded onto a rack that holds them in place for grinding.

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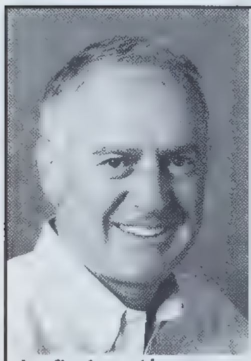
Another issue with serological testing is the purity of the antiserum. In some cases, an antiserum may react against more than one virus, or against other components of plant sap that were present with the virus when the antiserum was produced. This could lead to confusing results, or potentially false positive results if the antiserum reacts to something other than the virus. A good lab should use proper internal controls in each test and advise clients when a particular ELISA test for a pathogen is prone to this problem.

Molecular tests — PCR

Recently, molecular tests have been developed that directly target the genetic material (genome) of plant pathogens. Rather than relying on antibody reactions, they specifically test for molecular sequences that are unique to a particular pathogen. One of the most sensitive molecular methods for pathogen detection currently available is PCR.

PCR involves the selective amplification of a small part of a pathogen's genome. If the pathogen is present in a



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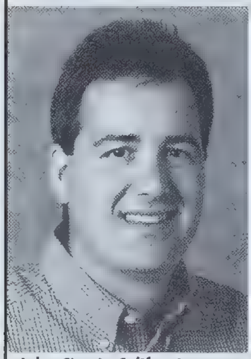

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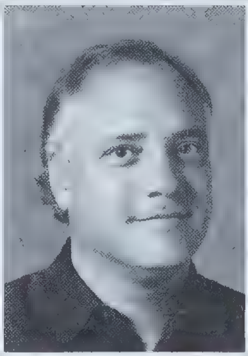

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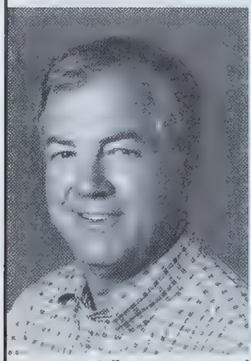

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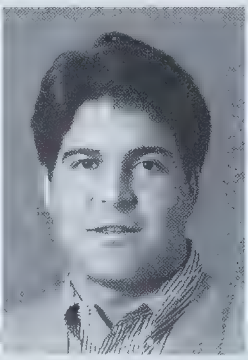

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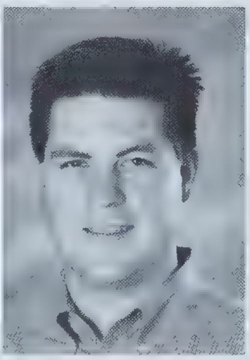

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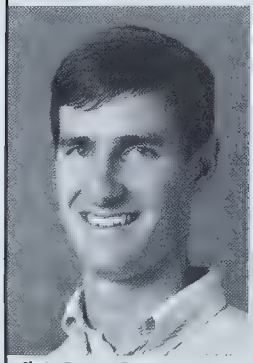

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sample, even in very low amounts, the amplification steps in PCR allow for its detection. It is this amplification that makes PCR such a sensitive test.

PCR can be used for the detection of pathogens in grape because each virus, bacteria, or fungus has its own unique genetic code. In the past decade, molecular scientists have identified genetic markers for many of these pathogens. Commercial PCR testing is currently available for many viral and bacterial pathogens of grapevines. This is an active area of research and this list is sure to expand.

Biological indexing

Before reliable laboratory tests were available for grapevine viruses, biological indexing (testing) was used to detect these pathogens. Herbaceous indexing is performed in a greenhouse in the spring and involves rubbing an extract from the test vine onto leaves of sensitive indicator plants. If certain viruses were present in the test plant extract, the indicator plants will develop diagnostic symptoms in several weeks.

PCR testing is available for the following pathogens:

- Arabis mosaic virus
- Grapevine fanleaf virus
- Grapevine fleck virus
- Grapevine leafroll-associated virus 1
- Grapevine leafroll-associated virus 2
- Grapevine leafroll-associated virus 3
- Grapevine leafroll-associated virus 4
- Grapevine leafroll-associated virus 5
- Grapevine rootstock stem lesion-associated virus
- Grapevine vitivirus A
- Grapevine vitivirus B
- Grapevine vitivirus D
- Phytoplasmas
- Pierce's disease *(xylella fastidosa)*
- Rupestris stem pitting-associated virus
- Tobacco mosaic virus
- Tomato ringspot virus

Woody or field indexing requires two years to complete. Indicator grapevine varieties that are especially sensitive to virus diseases are grafted with buds from the vine being tested. They are planted in the field and observed for two seasons for development of virus disease symptoms.

Although indexing tests are labor-intensive and time-consuming, they are still very useful if the vines being tested are valuable and a high level of confidence in the diagnosis is needed.

Reliability of laboratory testing

No diagnostic test is perfect. All the methods described above have the potential to produce false positive or false negative results.

False positives occur when a plant was actually free of a particular disease, but the test results indicate that it was present. False positives usually occur as a result of contamination or mislabeling of samples. These errors

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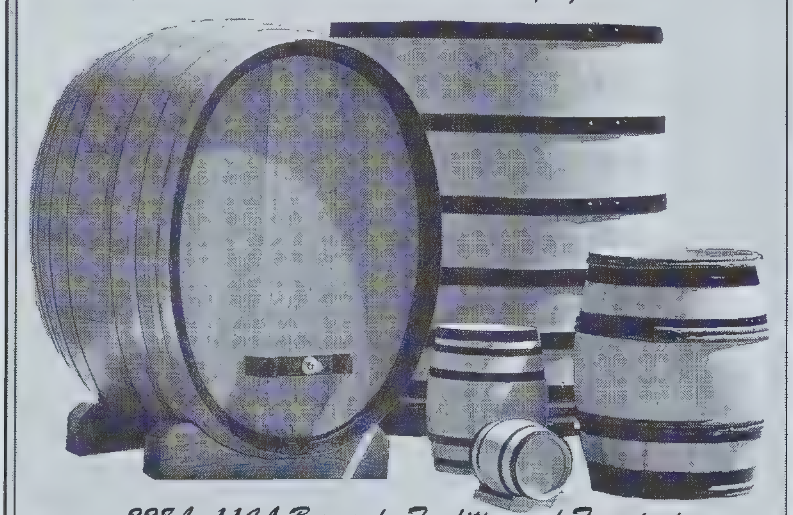

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Grapevine Virus Diseases

NEPOVIRUS DISEASES

This virus group includes at least 13 different viruses that can cause disease in grapevines. They share in common transmission by nematodes and a polyhedral physical structure when purified and examined with an electron microscope. This is the source of the name "nepovirus": "ne" for nematode, "po" for polyhedral. Fortunately, only a few of these viruses are reported to be of importance in grapes in the U.S.

Fanleaf Degeneration — Grapevine fanleaf virus — GFLV

GFLV is perhaps the best characterized virus of grapevines, causing fanleaf degeneration in affected plants. It is widely distributed throughout the world. Fanleaf disease is a major viticultural problem in California, causing reduced yields due to poor berry set. The reduction in yield can be over 80% in some varieties. Symptoms include fan-like distortions of leaves and chlorotic yellowing as ringspots, vein banding, and mottling or mosaic patterns. The virus is transmitted by the nematode *Xiphinema index* and can infect all *Vitis* species.

Yellow Vein — Tomato ringspot virus — ToRSV

ToRSV causes yellow vein disease. A similar disease is caused by tobacco ringspot virus. These viruses are transmitted by several species of nematodes including *X. americanum, X. californicum and X. rivesi.* Symptoms of both diseases include shot berries, shoot stunting, and devigoration of the vine. These diseases are common in vineyards in the eastern U.S. and in fruit trees, but are rarely seen in California vineyards. The symptoms of yellow vein resemble those described for fanleaf, and they can be easily confused.

Arabis mosaic virus — ArMV

This virus is widespread in grapevines in Europe. Although not found in California vineyards, it has recently been reported as common in Missouri and some infections have also been reported in Canada. Infected grapevines show symptoms similar to those of fanleaf, and ArMV can be present in a mixed infection with GFLV. Several nematode species can transmit ArMV to grapevines, the most common being *Xiphinema diversicaudatum.*

LEAFROLL

There are at least seven distinct viruses reported to be associated with leafroll disease. These viruses are collectively referred to as grapevine leafroll-associated viruses (GLRaVs) and are designated GLRaV 1 through GLRaV 7. ELISA tests are currently only available in commercial labs in the U.S. for GLRaV 1-5.

Symptoms of leafroll disease may include downward rolling of leaves, leaf reddening in the fall of red-fruited varieties, poor fruit color development, and delayed fruit maturation. Yield losses of 10 to 20% may occur. In cases of mixed infections with more than one virus, vines may be severely weakened and vine death may occur.

RUGOSE WOOD COMPLEX

Diseases in the rugose wood complex are characterized by trunk and stem disorders (pitting and grooving). Foliar symptoms similar to leafroll may also occur. Diseases in this complex include corky bark, Kober stem grooving and rupestris stem pitting. Their effects on grapevines vary from mild to severe. Disease severity is compounded when multiple infections of the rugose wood complex occur, or by the presence of other viruses such as leafroll.

In recent years, individual viruses have been discovered and characterized which has made the detection of these disease agents much easier. There are still some rugose wood diseases for which the agent has not yet been described, making it necessary to perform laborious and slow biological tests.

Rupestris stem pitting-associated virus — RSPaV

RSPaV is associated with rupestris stem pitting of grapevines. This disease is usually of little consequence. Decline due to rupestris stem pitting has been reported, but is not well-documented. RSPaV is widely distributed and is not targeted for elimination in most certification programs.

Vitiviruses — GVA, GVB, GVC, GVD

The vitiviruses are a group of viruses associated with the rugose wood disease complex. Four vitiviruses have been discovered in grapevines: grapevine vitivirus A (GVA), grapevine vitivirus B (GVB), grapevine vitivirus C (GVC), and grapevine vitivirus D (GVD).

GVA is associated with Kober Stem Grooving. Affected vines may show swelling at the graft union and fail to thrive. Ungrafted vines may be infected, but usually do not show symptoms.

GVB is associated with corky bark disease. The disease affects only grafted vines. The severity of corky bark is more pronounced in vines infected with other rugose wood complex viruses.

Neither GVC nor GVD have been proven to cause disease in grapevine but their structure and genetic profiles have shown that they belong to the vitivirus group.

FLECK

Grapevine fleck virus —GFkV

GFkV is a graft-transmissible virus that causes symptoms of disease only in *V. rupestris.* Other *Vitis* species can be infected but remain asymptomatic. In infected *V. rupestris*, symptoms include localized clearings (flecks) in the veinlets of young leaves. In older leaves, the symptoms diffuse into a mosaic pattern and the leaves wrinkle and curl upward. Symptoms persist during mild weather and disappear with the onset of hot temperatures. Very little information is available about the economic importance of fleck virus.

OTHER VIRUSES

Many other graft transmissible diseases, likely caused by viruses, can infect grapevines. These include asteroid mosaic, enations, vein necrosis, and vein mosaic, among others. These diseases have been studied to varying degrees, but have never been demonstrated to be common or severe.

Occasionally, new diseases appear that are significant. Recently, a new stem lesion virus disease was discovered in California (see *California Agriculture*, July-August 2001). Also known as Redglobe virus, this disease can kill vines on certain rootstocks. Continuing research is necessary to identify important new diseases like this and to develop diagnostic tools to help minimize their future impact.

could occur in the field when samples are collected, or at the lab after the samples arrive.

Contamination is of particular concern with PCR because of the sensitivity of the test. Just a few bacteria or virus particles carried over from one sample to another could lead to false positive results. With ELISA, false positives can also occur if an antiserum reacts against plant constituents in addition to the targeted pathogen.

False negative results are much more common than false positives. False negatives occur when diseased vines are tested but the test results indicate that no disease agent was present. Most false negatives occur because the sample from the diseased vine did not have disease agents in it, or the sample was mishandled and was not in good condition when it arrived at the lab.

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Virus infections are usually unevenly distributed in vineyards. Even within a single vine, viruses may be present in some parts but not others. If the tissue sent to the lab was from a part of a diseased vine that didn't contain virus, the result will be negative, albeit a false one.

False negatives can also occur due to a variety of problems at the laboratory that compromise the testing procedure. Good laboratories include controls in their tests in hopes of identifying these types of problems so that the test can be repeated.

Sample selection and handling

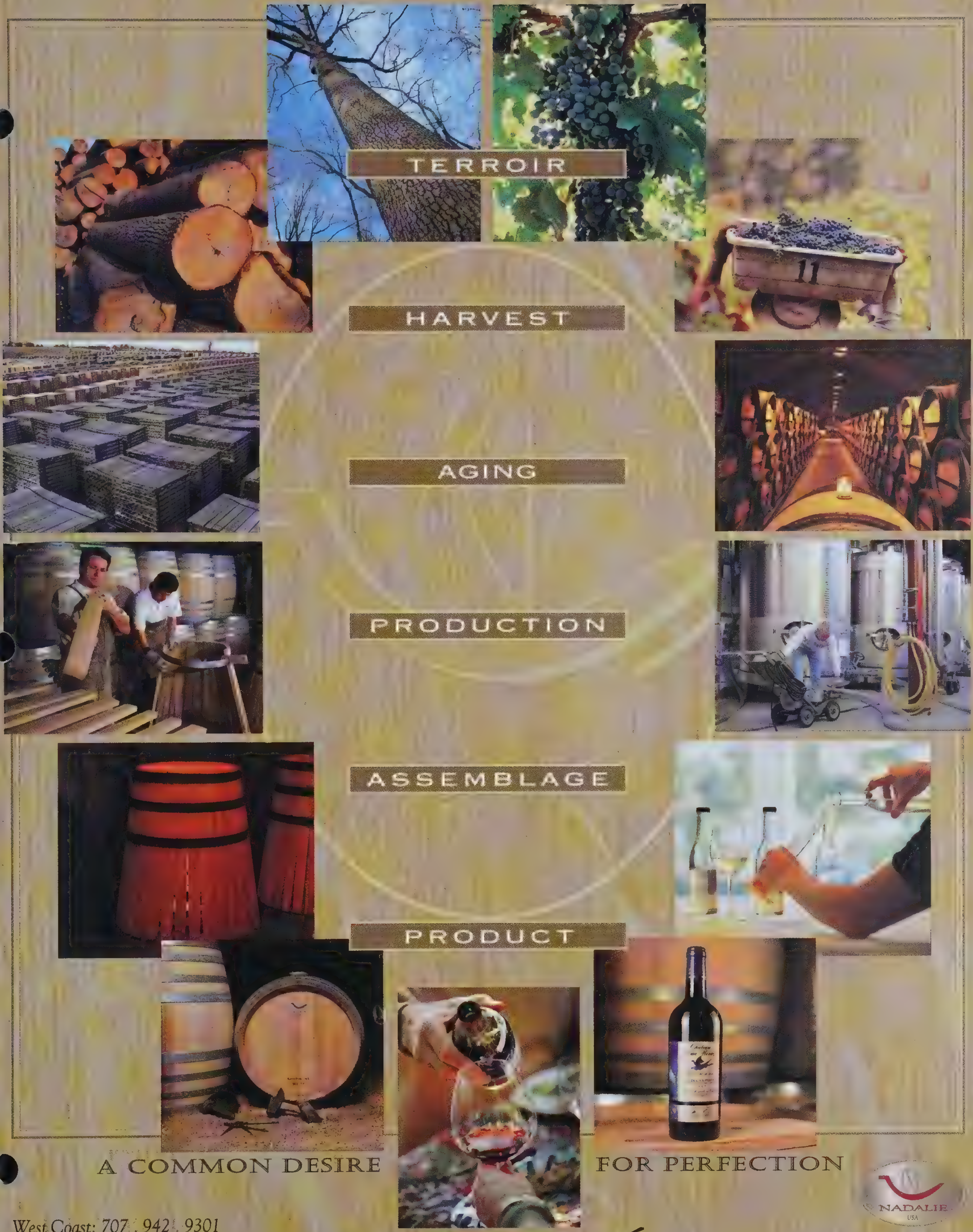
Sample selection is important for minimizing the chances for false negative results. Sampling particular parts of the vine at certain times of the year can greatly increase the reliability of disease testing.

For example, to test vines for Grapevine Fanleaf Virus, shoot tips should be collected for testing in the spring. This virus is heat-sensitive and during summer, its concentration in vines becomes very low, making disease testing more unreliable. See Table II for additional sampling recommendations.

Proper handling and shipping of samples is also important. In general, samples should be delivered to the testing lab as soon as possible. If the samples have been exposed to excessive heat or drying, or if they are stored for too long, it will not be possible to get reliable results. Be sure to consult with a lab for recommended delivery instructions.

Interpretation of results

In general, the larger the number of samples sent from a vineyard for testing, the higher the confidence level in the results. Keep in mind that in a given vineyard, more than one virus can infect individual vines, and it is possible for vines in the same vineyard to be healthy, infected with only one virus, or infected with more than one virus.



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Positive results from a laboratory can generally be counted upon to be accurate. False positives are not common unless there were significant problems at the lab. Most labs run internal controls to check for these types of errors. However, if you suspect a problem because every one of your samples comes back positive, you might consider running them again. Including a healthy sample along with your diseased ones is usually a good idea.

Negative results, on the other hand, are of limited value. Because of the problems inherent in sampling, the uneven distribution of disease agents in vines and concentration changes during the year, false negative results occur with high frequency. Keep in mind that a negative test result does not mean the vine is free of the disease being tested for.

If you suspect that a vine is diseased but the test results come back negative, don't let this be the end of the story. Consider other evidence such as vine performance and symptom expression, then do further testing until you are satisfied.

If you are using laboratory tests to screen vines for propagation, extra care is needed. Foundation vines in the California Registration and Certification program are tested over a period of at least two years using a combination of biological indicators, ELISA, and PCR tests. This provides a very high level of confidence about the virus status of the selections.

Although practical considerations may require the use of wood from commercial vineyards for propagation, particularly for field budding, it is highly recommended that growers do everything possible to avoid spreading pathogens with the wood.

Disease tests cannot be used to determine the general "health" of a grapevine. Rather, they can help determine whether or not a vine is infected with the particular pathogens being tested for. Because tests are not available for all known grape diseases, no vine can ultimately be declared "disease-free." However, the new laboratory technology available today makes the job of diagnosing vineyard diseases far more reliable than it has ever been in the past. ■

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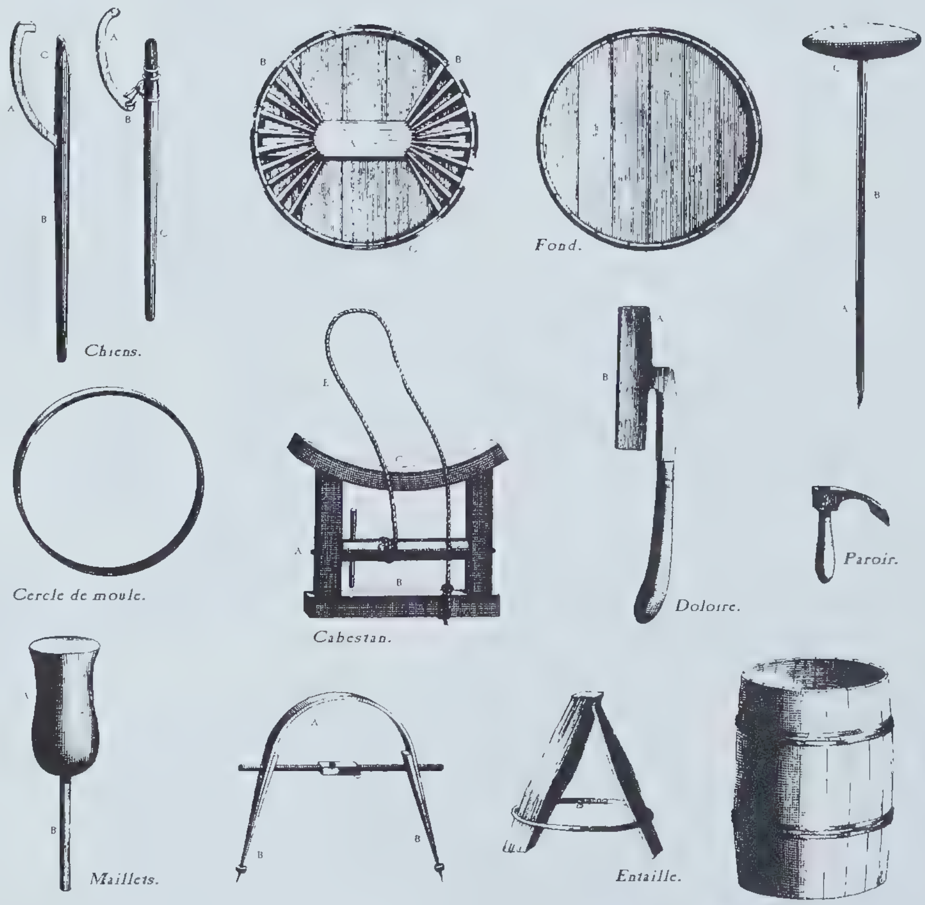

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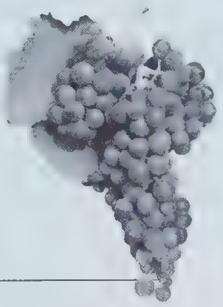

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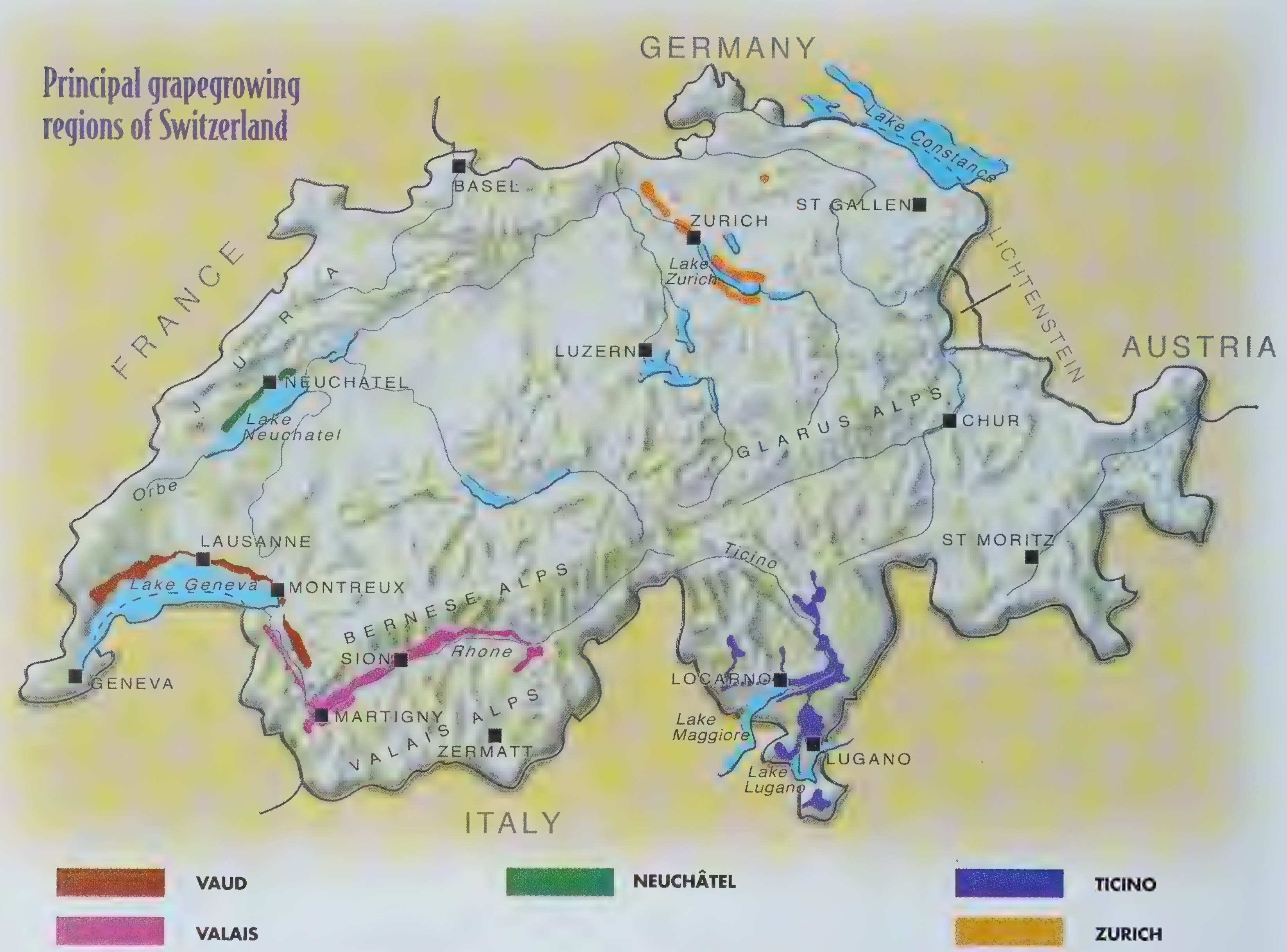

Principal grapegrowing regions of Switzerland

Sustainable viticulture in Switzerland offers global model

BY Eleanor & Ray Heald
Contributing editors

Similar to the U.S. over the last decade, sustainable agriculture in western Europe has challenged grapegrowers and become a significant social and environmental issue with political implications.

Concerned about the proximity of agricultural lands to population hubs and major water supplies, Switzerland in the mid-1980s developed a viticultural approach less dependent on agrochemicals (insecticides, fungicides, herbicides, and fertilizers).

"Consumers demand top-quality wines, but they are also concerned about how the grapes are grown and under what conditions the wine is produced," says Philippe Cuénat, Dr. Ingénieur *en sciences alimentaires EPFZ* at the *Station Fédéral de Recherches en Production Végétal de Changins* (Switzerland). Consumers demand to know what they are eating and drinking. They do not want pesticide residues in their wine.

"Switzerland is a small country so ecological aspects are important, but we believe we have developed a model that will work on any scale. Strict rules for all environmental issues are necessary. This attitude is growing around the world, and consumers are driving the wine industry to be more sensitive to the use of chemicals in food and beverage products."

Through collaboration among Swiss researchers at the *Station Fédéral de Recherches en Production Végétal de Changins* near Nyon and a similar facility in Wädenswil, Production Intégrée (translated "Integrated Production" [IP] and related to sustainable viticultural practices), arose as a model for grape growers. Encouraging practices which result in a reduction of chemicals used in the vineyard is the primary goal.

Before being recommended to grape farmers, IP practices under an umbrella name VITISWISS focused on establishing and maintaining ecologically diverse flora and fauna within vineyards. These were evaluated at both research stations over several years. Recommendations came from research based on experiments — not philosophy.

Ecological diversity within vineyards has reduced major pest, insect, and mite populations, such as the grape berry moth, European spider mite, and two-spotted spider mite to tolerable levels. Improved canopy management along with more ecologically sound sprays, such as fennel oil, have lowered the incidence of black rot, botrytis, dead-arm, Brenner, and downy and powdery mildews.

Regulations and flexibility

Wine grapes are grown in all 26 cantons (which function as independent states) of Switzerland, where four languages are spoken in a country slightly less than twice the size of New Jersey. Ecological sensitivity for over 37,000 acres of vines has been a major governmental undertaking. Initial IP efforts have expanded to a system of voluntary certification known as *"Le Certificat* VITISWISS."

In western Switzerland, the French-speaking canton of Valais produces 35.5% of the country's grape total. This is followed by 25.5% in the Vaud, 9% in Geneva, and 4% in Neuchâtel. German-speaking Switzerland, often referred to as "eastern Switzerland" but geographically more north than east, produces 20%. Ticino in the south accounts for 6%.

The Valais is a prime example of why regional modifications to the general VITISWISS certification regulations are necessary. Modifications are based on considerations of altitude, soil composition, vineyard orientation, rainfall, wind direction and intensity, planting density, training and trellising systems. Planting densities are tighter in western Switzerland than in the east.

In the Valais where vines are grown low to the ground, they are either staked

Pergola training system of growing Pinot Grigio in Italy's Alto Adige. (Photo by Ray Heald)

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Goblet-pruned vines at 13,000 vines/hectare (ha) or Guyot at 8,000 to 10,000 vines/ha, on a three-wire vertical shoot positioned trellis (VSP). Except where soils have a significant limestone content, vines are principally on 3309 rootstock.

Created by the Rhône River cutting its way through steep hillsides (some 1,000 meters in altitude), the Valais angles south near Martigny before turning east. The region has the driest and warmest climate in Switzerland. Thin, barren soils on terraced slopes with multiple orientations create the patchwork of vineyard blocks suited to the broadest varietal plantings of 50 grape varieties.

Due to low rainfall amounts of about 500mm to 600mm (20 to 24 inches) annually, it is impossible to sustain the growth of cover crops. Forbidden in other areas, drip and some overhead irrigation are used, not to push production but to maintain vine balance.

Chasselas, the country's mainstay white grape, is followed in the Valais by lesser but still significant plantings of Sylvaner, Pinot Gris, Chardonnay, Petite Arvine, Marsanne, and Muscat Blanc à Petits Grains. Pinot Noir is the predominant red variety with approximately 1,850ha (4,600 acres) under vine.

In the mainly dry-farmed, German-speaking cantons of Switzerland with 900mm (35 inches) annual rainfall, well-distributed during the growing season, the main varieties are Pinot Noir and Riesling x Sylvaner cross on 5BB, 5C, or 8A rootstocks.

Patrik Schönenberger, viticulturist at Andreas Meier & Co. in Würenlingen, explains that vines are grown with a 1.3m high canopy "at a comfortable height for working. The fruiting wire is located at about the height of an average-sized man's hand above the ground. With this in mind, we also look for balance between root volume, the established part of the vine, new growth, and yield.

"When the new growth begins to fall downward over the top of the five-wire vertical trellis, excess growth is cut by a machine that straddles the vine. Steeper and terraced vineyards must be hedged by hand. Workers stand on top of an elevated belt-driven board."

As the introductory paragraph of the special ecological requirements for obtaining the VITISWISS certificate suggests, IP cannot follow restrictive rules. It is a dynamic process that requires ongoing development. Yearly, winegrowers add additional ecological efforts to permanent development by choosing to fulfill a minimum number of options from among 50 available in the certification process.

Distinct growing regions, such as the Valais, have adapted VITISWISS ecological practices specifically to their area by organizing VITIVAL and encouraging commitment among growers there. In the German-speaking cantons, certification modifications to the country model are known as VINATURA.

Certification overview

Fifty aspects of viticulture are grouped into categories: yield and

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quality, soil and fertilization, soil cultivation and weed control, disease control, pest control, enology, and a miscellaneous segment including vine training and vineyard equipment.

Each of the aspects are evaluated annually on a merit-demerit system. Merit points are awarded when action taken by a grower reduces pesticide and fertilizer use and promotes fuel economy and general ecological diversity. When actions follow "traditional" grapegrowing practices (those that do not utilize available alternatives), no points are awarded.

Demerit points are based on 42 well-defined criteria considered serious violations of IP objectives. They include overcropping, application of nitrogen fertilizer in excess of 50kg/ha/year, post-bloom copper application exceeding 4kg/ha/year, application of more than seven fungicide treatments against downy mildew per growing season, and use of any pesticide toxic to selected predatory mites and insects. Receipt by a grower of any one of the demerit points disallows certification in that year.

If certification conditions are fulfilled, a grower receives 1,000 to 1,200 Swiss Francs/ha from the government (about $600 to $700/ha or $236 to $275/acre).

Who checks on regulation fulfillment? "It is self-controlled by the grape farmers who have taken courses and who are generally members of a regional group, such as VITIVAL in the Valais or VINATURA in eastern Switzerland, committed to check each other on the use of sound practices," Cuénat responds.

While this may sound like big brother to an American, Swiss growers we talked to did not view it that way. They considered themselves part of an ongoing commitment, and regulation reminders at grower meetings were welcome.

When a grapegrower commits to IP, the regional group (such as VITIVAL) checks the vineyards the first year, then the vineyard becomes subject to a random, unannounced check in following years. It starts with records maintained on soil amendments, pesticides used, irrigation, fertilization, and other aspects of IP.

Soil and fertilizer

Cuénat notes that before IP began to make an impact on grapegrowing, introduction of excessive amounts of nitrogen in the soil was common practice, which began to pollute underground water sources. If nitrogen is deemed necessary as a fertilizer, an untreated plot of 200 square meters (m^2) must be created as a reference standard.

Nitrogen application amounts for various allowable commercial products are calculated as elemental nitrogen, not as nitrates. Application followed by cultivation under the vine is encouraged to increase efficiency and reduce the quantity needed.

To enhance organic substances, natural compost, cow manure (applied late winter or early spring), and nat-

Portrait of the Artist's Mother (detail) by Albrecht Dürer dated 1514.

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ural tall species of dried grasses are introduced in the vineyards.

At pruning, vine cuttings of four- to six-inch lengths remain in the vineyard to become part of the soil over time. "Removing cuttings from a vineyard eliminates an opportunity to develop good biological activity and increase organic content of the soil," suggests Dr. Olivier Viret, plant pathologist at the *Station Fédéral de Recherches en Production Végétal de Changins.*

When vines are hedged, these cuttings also remain on the ground. Different systems of machine cultivation integrate the soil amendments or, often, they lay on the surface and degrade naturally in three to four years.

Nitrogen, phosphorus, potassium, calcium, and magnesium are the most important elements regulated. Sulfur is not regulated, but eight kg/ha per year is advised. Except in Ticino where soils have high acidity, soil pH adjustment is unnecessary.

Farmers applying for or attempting to retain IP certification are obliged to have an annual soil analysis from the federal research station in the region. Feedback is provided within approximately two weeks. Each block within a vineyard is characterized, and farmers fertilize only in relation to the analysis.

Tissue and petiole analysis in July or August determine the effectiveness of soil amendments. This is not an annual requirement. Most farmers choose to test every two to four years.

"Such recommendations," says Schönenberger, "are good aids. Nothing, however, substitutes for how a vine looks. If the leaves turn yellow, it might be nitrogen deficiency, but there are more symptoms to view than that. If a viticulturist has learned the signs, he can intervene long before the report of an analysis is returned."

Soil analysis is also valuable in identifying plant physiological disorders such as chlorose, excess water retention, or excess vigor.

At Andreas Meier & Co., Schönenberger relies on a "leaf-wetness meter analysis," important for downy mildew disease treatment. He explains that leaf-wetness meters at the top of the canopy, distributed in various vineyards throughout eastern Switzerland, determine the number of hours a leaf remains wet each day.

Collected data is sent from the Wädenswil research station to vineyards via fax. If it's known how long a leaf has been wet (plus additional information including air temperature, air humidity, amount of rain), then the proper timing of the next downy mildew treatment can be predicted..

To predict downy mildew infections, both federal research stations and regional IP organizations have contributed to construction of a network of approximately 150 weather stations. Data is centralized daily and distributed to growers. Internet access of the data is being developed to allow growers to react faster to projected incidents.

Effectiveness of foliar fertilizing remains in doubt. Therefore, if a grape

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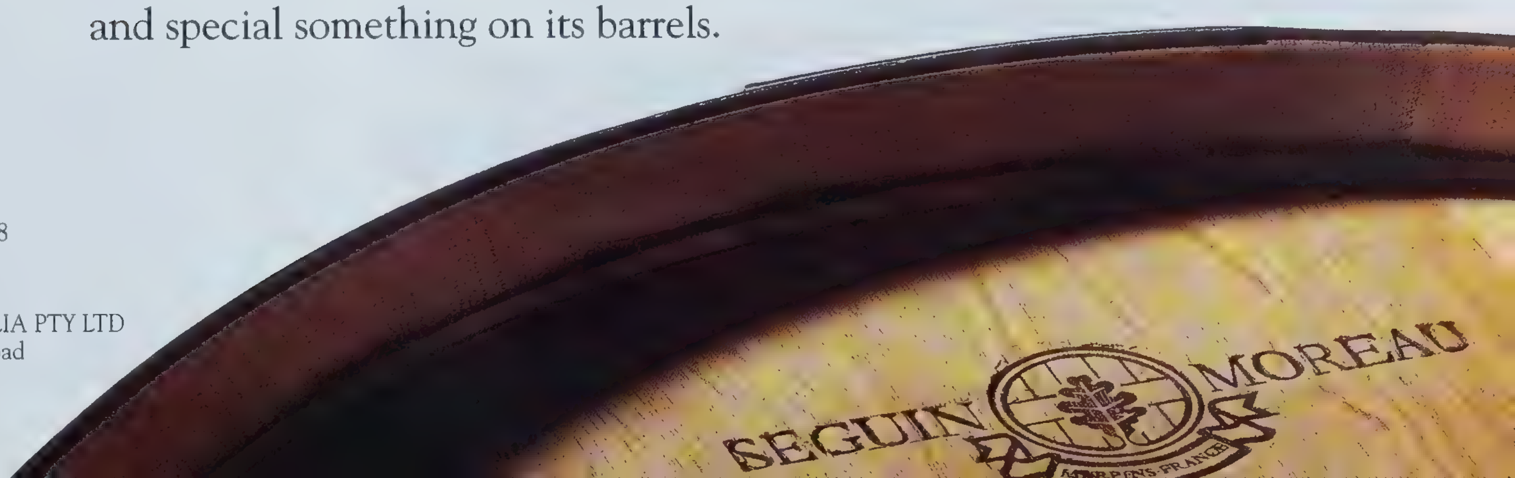

farmer wishes to experiment with such spraying, a minimum 100 m^2 leaf fertilizing zone must be created as an efficiency testing area.

Soil management

All recommendations under this topic are aimed at reduction of herbicide and fertilizer use as well as a significant increase of biodiversity. Any new technique a farmer wishes to introduce must first be conducted on a vineyard block of at least 1,000 m^2. For terraced blocks, this area may be reduced.

Under IP viticultural regulations, a once-per-season (April to June) minimal application of herbicides from the recommended list may be used to control vineyard weeds in the vine row along a 30cm (12-inch) wide band.

Viret says it would be most desirable to totally eliminate herbicide use in vineyards, but the problem of grass in the vine row is so great that grape farming in a country with virtually no unemployment and a small labor pool is impossible. The French hoe is routinely used to control weeds in the vine row.

In closely-spaced rows less than 1.50 meters and in vineyard blocks smaller than 1,000 m^2, application of herbicides is forbidden. To prove a need for the use of root herbicides when spacing is wider or on larger blocks, tests followed by analysis must be done on an area of at least 1,000 m^2.

Clover species, native grasses, or herbs are used for permanent cover crops planted in alternate aisles where it is possible to grow them (usually not on steeply-terraced vineyards or in arid regions). Mowing of the cover crop every fourth aisle should be done when the species are blooming. In new vineyards, seeding is done in spring.

Schönenberger suggests the main cover crop advantages. "When the recommended procedure is followed, there are blooming flora throughout the season in the vineyards to attract beneficial insects. Economically, mowing is done in less than half the time and workers are freed to work on other vineyard jobs. Also on occasion, if a vineyard needs a nitrogen boost, cover crop legumes can provide this."

Cuénat notes that perennial cover crops, promoted in every aisle, may result in wines with a weedy flavor profile, independent of varietal in different regions.

Especially with the cultivars Chasselas, Gamay, and Pinot Noir, one of the most important challenges to growers is vigor related to fertilization and clonal selection. Even on less-vigorous rootstocks, with cover crops, and without nitrogen, vigor is difficult to control. In some years and in high clay-content soils, perennial cover crops can sometimes lead to an imbalance in water-nitrogen content that negatively impacts wine flavors.

Tractor compaction is not an issue directly addressed in IP. Yet Viret thinks it is an issue to be addressed. "But if you ask the growers, it's not,"

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he maintains. "I am certain it has some effect. Especially in vineyards with mature cover crops, you can maneuver tractors even in wet conditions with heavy soils in a region like La Côte in western Switzerland."

Viret believes the design of tractors with large tires would make a difference.

Pest control

In 1997, after 15 years of research at Changins in cooperation with grapegrowers, control of the grape berry moth, the major vineyard insect problem inducing rot, was accomplished by the use of pheromone capsule dispensers strapped onto trellis wires at regular intervals. The pheromone causes sexual confusion for the males of the species.

Dispensers create a cloud of pheromones over the vineyard, and the male cannot locate the female in order to reproduce. In years when capsule dispensers are not placed in the vineyard, berry moth traps (akin to No-Pest strips) attracting the male are placed in the vineyard, providing a male population estimate.

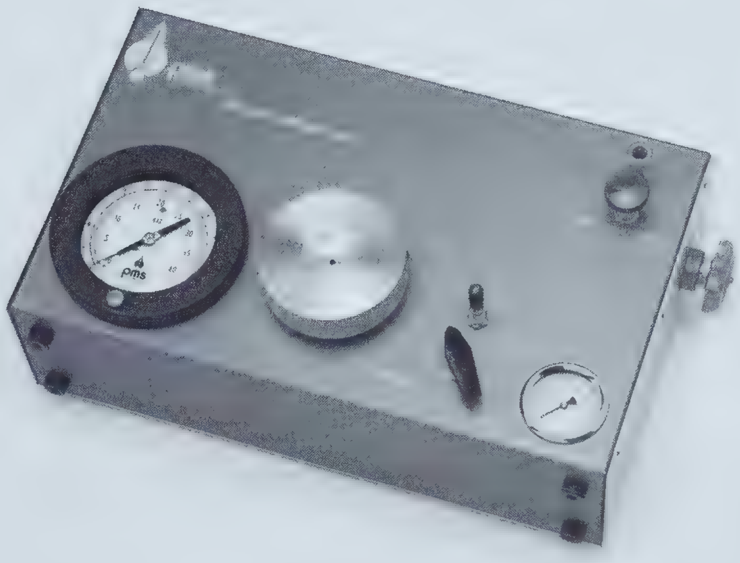
"Controlling the grape berry moth may be the most important aspect of our research," Viret reports. "In Switzerland, spraying of insecticides is no longer necessary. This is a major difference between Switzerland and other European wine-producing countries that annually continue to use two to three sprays. Since insecticides are no longer used, a predatory mite, *Typhylodromus pyri,* has been encouraged as a natural pest control."

"If there are no mites to feed the vineyard *Typhylodromus pyri* population," Schönenberger reports, "they can survive on weed pollens. This suggests another value of cover crops."

Because it kills *Typhylodromus pyri,* Viret and his colleagues worked to find substitutes for the once widely used Mancozeb. Official registration of fungicides requires neutrality to predatory mites as one of the most important considerations. Dithiocarbamates (*i.e.* Mancozeb) are the last group of fungicides with known toxicity against predatory mites still in use. Use is restricted to only one spray at the beginning of the growing season. Many substitutes have been registered and their use has nearly replaced dithiocarbamates.

A complete list of effective fungicides, their European commercial names (along with all acceptable agrochemicals), prescribed application amount, number of allowed applications, and effectiveness are listed in *Revue Suisse de Viticulture Arboriculture Horticulture* in the supplementary index *"Phytosanitaire pour la viticulture"* published by *Station Fédéral de Recherches en Production Végétal de Changins*, Rte de Duillier, CH — 1260 NYON 1/Suisse.

Recently, in the German-speaking cantons of Switzerland, certain species of hedges located near vineyard blocks have been recognized as potential *Typhylodromus pyri* sources, but migration from hedge to vineyard has been slow.



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Consequently, populations of the predatory mite have been artificially released in vineyards to create desired populations.

Since the predatory mite winters over beneath bud scales, establishing new *Typhylodromus pyri* populations has been aided by a promising new technique. It involves tying two-to-three-inch strips of woolen fabric at the base of shoots that have established populations of the predatory mite. They crawl under the woolen fabric in autumn. The following spring, the fabric with a developing predator population is removed and used to inoculate a new vineyard.

In addition to predatory mites, lacewings, parasitoides, anthocoridae, and spiders are playing an important role in the balance of fauna in the vineyard.

Reduction of spray drifting is encouraged by the use of anti-drift jets, recycling machines, and tunnel spray guns. For more information on equipment to reduce spray drift, readers are encouraged to contact Werner Siegfried by email: werner.siegfried@faw.admin.ch at the federal research station at Wädenswil.

Biodiversity

Reduction of a monoculture is promoted by vineyard hedge borders where possible. "The difficulty," Viret notes, "is that there are many owners of small vineyards. The property lines abut, and it is not always possible to create a compensation area between the blocks with different ownership.

The Valais region illustrates just how small individual vineyards are. Of the 22,000 vineyard owners, 800 are VITIVAL members. Each owns an average of 1,500 m^2 or 0.5 ha (1.25 acres) per owner.

A temperature data collection project is under development throughout Switzerland, but the data remains insufficient at this time to assess how directly proportional temperature is to microbiological activity and overall wine flavors. "The living soil model interests us and deserves attention worldwide, but it is an expensive project," Cuénat notes.

Biodynamic research

Viret explains that some progressive grapegrowers already committed to the IP regulations began biodynamic practices in 2001. "For us as scientists and researchers, biodynamic grapegrowing is, at this time, a curiosity because it is impossible for us to promote what we do not understand," he contends.

"Research station personnel are cooperating with several grapegrowers interested in biodynamic principles. Identical varieties are being grown in side-by-side vineyard blocks — one block under IP regulations and the other with biodynamic practices. Over several years, wines will be made and evaluated from both blocks.

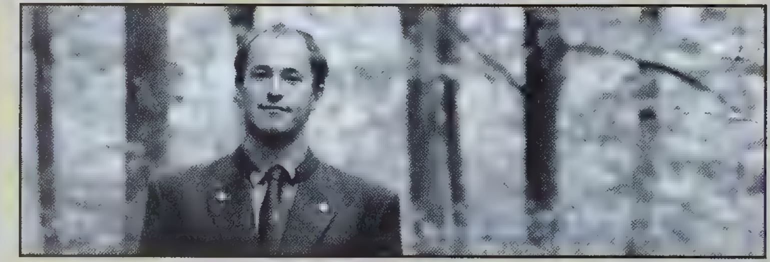
"Yet at this point, I am alarmed that under biodynamic theories, one grape farmer sprayed $CuSO_4$ on the ground three times prior to bloom. Under IP, $CuSO_4$ spraying is allowed only post bloom. We believe that $CuSO_4$ spraying has far exceeded need in many wine growing regions of the world. While 4kg/ha/year of copper spray is allowed under IP, growers committed to the model have already proven that for many vineyards 2.5kg to 3.5kg/ha/year is just as effective."

Conclusion

"In Switzerland, IP is now at the point where it is an exchange between practice and theory," says Viret. "In France, particularly in the Alsace region which employs a system similar to VITISWISS, certification is made under the controls and checks of a private organization. Certification is expensive. Commercially in Switzerland, it would make sense for the growers to have a private certifying agency.

"Switzerland has an official system depending on government funding, but because of the high costs, regions in other countries using private sector financing will be able, perhaps, to go further and quicker than we can progress. Our standards, however, have been recognized by the world's top winegrowing regions." ■

*The authors and **PWV** thank Swiss native Ruth Mathys for translating the official VITISWISS regulations from German to English.*



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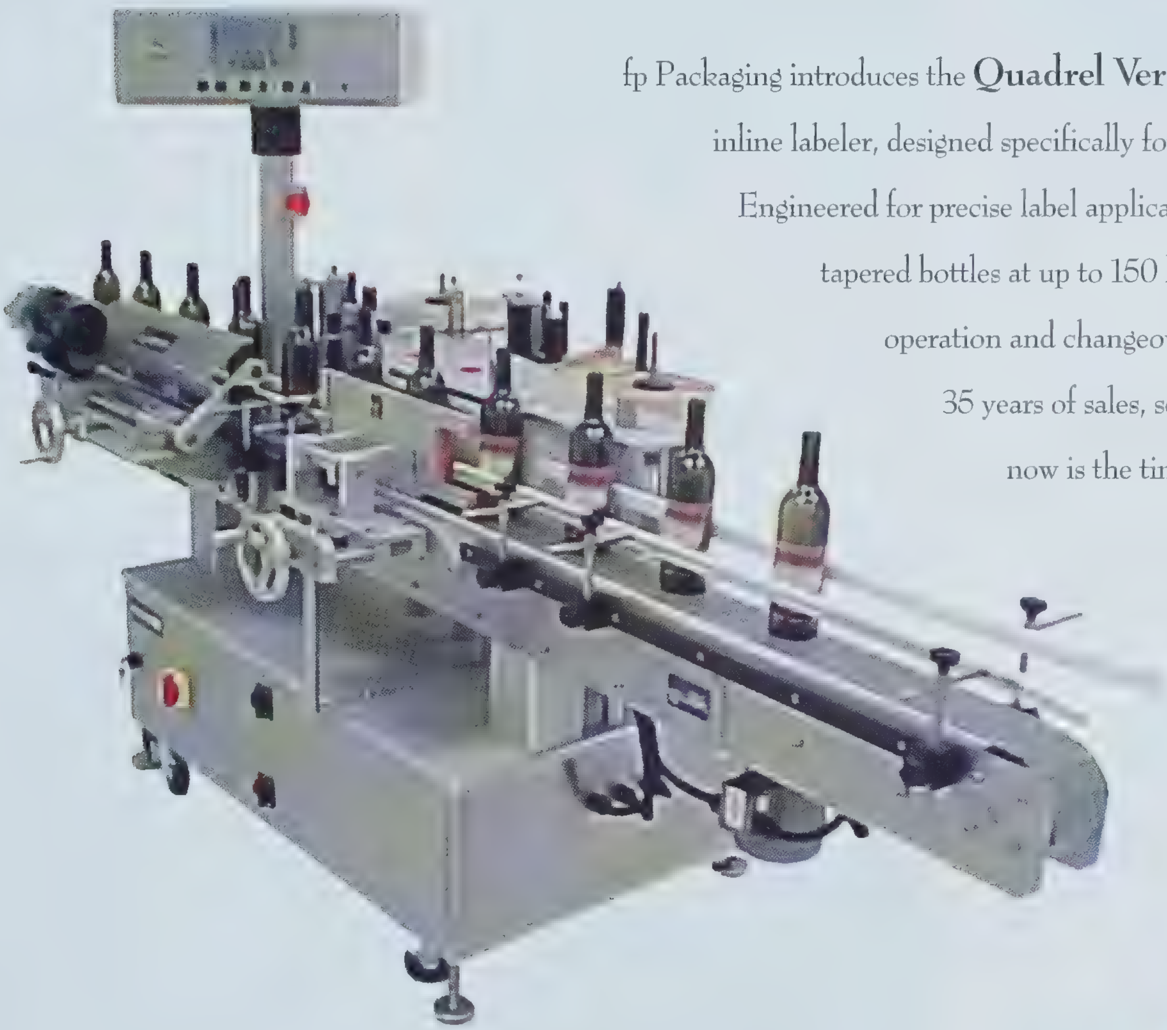

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Creating a regional visitor center

BY Craig Root

Many wine regions all over the U.S. could benefit from a visitor center program.

A regional visitor center offers tastes and sells wines from as many local wineries as possible. It also acts as a referral agency to tasting rooms and other area attractions, such as nature preserves and food and lodging businesses.

This article will review the creation of one such center in Lodi, CA, for which I consulted.

The Lodi Wine and Visitor Center

This regional visitor center was launched in 2000. First year attendance was 15,000, and projections call for 50,000 visitors annually within three to five years. Preliminary reports indicate that more than 60% of the visitors went on to visit winery tasting rooms in the area, such as Mondavi Woodbridge and Peirano Estate Winery. Visitors have also been directed to other local businesses and points of interest in the surrounding countryside and vineyards.

Mark Chandler, executive director of the Lodi-Woodbridge Winegrape Commission (sponsors of this project) advises: "You'll need a clear set of goals to start with. Ours are to bring people to Lodi, to bring them to Lodi wines, and to bring them to wine in general — in a friendly and helpful way.

"The second thing you'll need initially, of course, is some business group board of concerned winery principals and local residents to shepherd the project to completion, and most important, fund the creation. For us, the board of the Winegrape Commission was the first source of direction. Also, having some financial reserves from the very profitable years in the 1990s was a great catalyst.

"I also recommend that it's much better to draw on spontaneous support rather that talking people into the project. Besides the initial project funding, you'll also need some revenue forecasts."

Another important step is to acquire tax-exempt 501c3 status. This entails a two-part process leading to becoming a non-profit organization. The process requires state and then federal government approval.

The advantages of non-profit status are twofold: 1) the well-known tax considerations and other government assistance; and 2) the ability to get the proper licenses for your facility, particularly given the complex process of licensure with your state alcohol commission. Just because you have a board doesn't mean it has the ability to acquire proper licensing.

Plan on using legal/compliance help to guide you through this step, which is a good reason to have a legal person on your board or team who can offer pro bono assistance. A good accountant wouldn't hurt either.

This is also the time to be canvassing the community from the grassroots to winery principals about what they would like to see in the facility. The more people feel included in the process, the more they will be inclined to support you.

Planning

It's crucial to use in-house "brainpower" to work on the business plan, income and expense projections, and timeline. If you don't have it, you will need to bring in a consultant who specializes in the complexities of a startup visitor center. I often tell my clients: I'm here for two reasons, first, to make your operation more profitable and

The Lodi Wine and Visitors Center opened in 2000 and attracted 15,000 visitors in the first year.

memorable, and second, to keep you from making expensive mistakes.

For example, on another regional visitor center which I worked on, we all thought that the facility would require three touch-screen computers to help visitors find information about the region. But I always insist on doing a survey of current tourists in the area to see what they want. There's no point in putting on Shakespeare and finding out afterward that your audience really wanted Neil Simon.

Here's a tip: poll people at gas stations (with permission of the owner). The contents of their cars and trucks will indicate whether they are tourists. (Look for luggage, and sports or recreational equipment.) They are stuck at the pump for a couple of minutes and they usually won't mind answering a few pertinent questions.

We learned that interactive computers were low on the list of priorities for potential visitors. So we planned for one interactive computer instead of three. Our basic research saved the center some $40,000 to $60,000.

Another note of caution from Chandler: "Be aware that interactive displays are very complex to maintain, or to change content once you have them in use. Be prepared for some extra expenses if you choose this route, and insist on previewing all content in advance of installation."

I also caution people to put expensive attractions in a prominent place. But "prominent" isn't always where you might think it is. For example, when visitors first enter a public facility, they are getting oriented to the building and aren't ready to settle in anywhere. So don't put expensive displays right next to the entrance.

As you develop the income/expense report, project three to five years out. It should reflect categories too numerous to list here. This is just another reason to use a specialist, who will have

From behind the Lodi Visitor Center's tasting bar, this wall display of all wines using Lodi-Woodbridge grapes impresses upon visitors the quality of the grapes and wine from the region.

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lists of revenues and expenses (even as trivial as window cleaning), which you probably haven't even imagined.

Next, create a timeline for completion of specific parts of the project. Do your best to calculate these and then add at least 50% more time to be on the safe side.

Site selection

Location, location, location — we've all heard that too many times because it happens to be true. One tip in reviewing potential sites is to check your state highway commission's website. In California, CalTrans has a website that shows yearly traffic volume on any given road.

For example, another regional visitor center I'm working on, The Redman House in Watsonville, CA, near Santa Cruz, is right by a freeway where more than 13 million cars pass by annually. We don't have to siphon off a big percentage of those to reach our goal of 20,000 visitors the first year and 80,000 by year five.

Remember, as Chandler notes, "Just like when you're shopping for a home, there is no perfect house. You will probably never find everything you want in one location, so have a strategy to deal with your site's shortcomings."

For instance, you could get a sweetheart deal on land or a facility, but if it is too far from the local wineries, or is hard to find even with good signage, or doesn't have enough traffic close by, it's not really a sweetheart deal.

The three considerations above should stand as keys to your choice. In the case of the Lodi Center, "Even though we are in town as opposed to out in the vineyards," says Chandler, "we have reasonably good highway access. Also, we are located on the grounds of Lodi's premier B&B, (Wine & Roses), and we took in another tenant — the Lodi Conference and Visitor Bureau."

But Chandler cautions, "This has worked out very well, but make sure up front that you and your partners know exactly how much floor space each entity will get and how much energy and attention will be allotted to each entity.

"In hindsight, I wish we had planned for more office space because housing the Winegrape Commission, the Visitor Center management, our Integrated Pest Management Team, and the Visitor Bureau folks, we're really pressed for office space."

If you do partner with someone else, it is essential to make sure you are dealing with people who have the funding, and more important, the actual power to effect the deal. You may be engaged with someone who has the title of president, but who in reality must get approval from a county agency. This advice can save you some very real (and very expensive) headaches.

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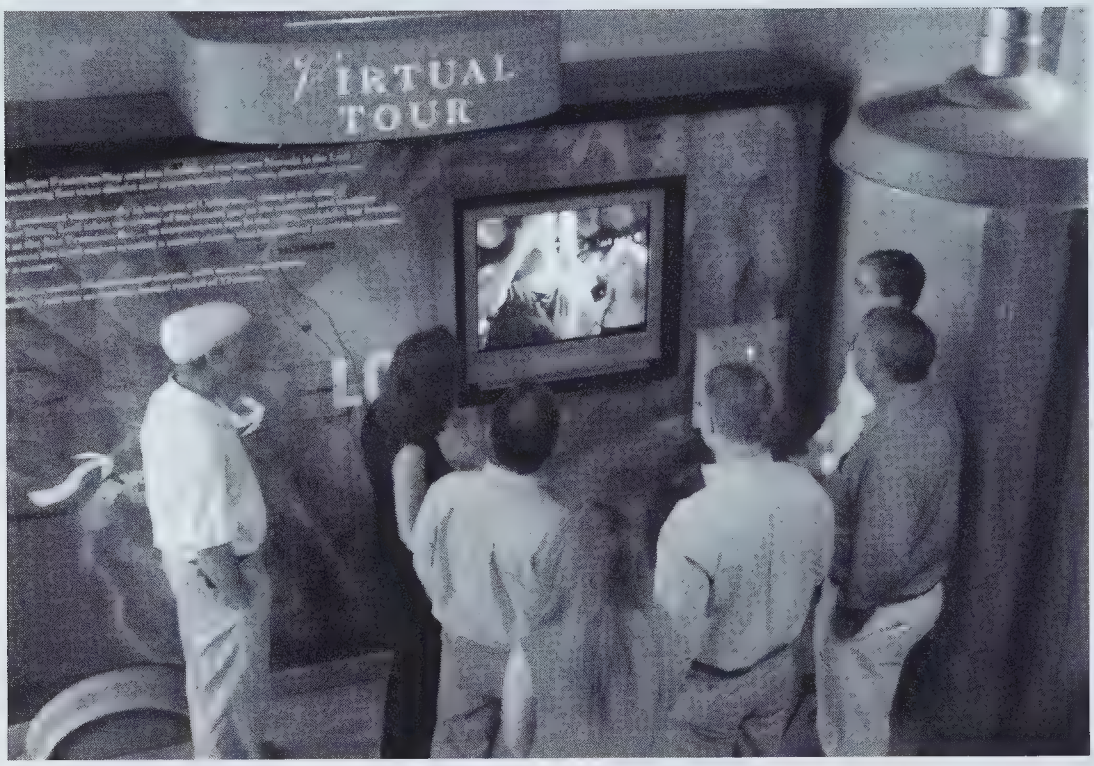

The "Virtual Tour" interactive exhibit provides a video introduction to the region and a short feature on each of the local winery tasting rooms.

One other cautionary note is that some states have tourism signage that will direct visitors to your site from the local freeway as a state-supported visitor center. Think this possibility out and talk with other businesses who utilize this free service. Does it bring the kind of customers you want, or merely people looking for a "pit stop?"

Construction

I would highly recommend having someone knowledgeable about construction on your board who can provide you with construction-expense forecasts. "In our case, we got lucky because the Wine & Roses management supervised construction," reports Chandler, "since it was on their land. But they did it to our specifications.

"Obviously, this is a win/win situation because, for example, they host a lot of weddings, and those guests visit our facility before and after the ceremony. Conversely, with our advertising and outreach, we bring a lot of folks onto the grounds and expose them to the Wine & Roses facility."

Staffing

Before construction begins, you need a detail person on board. "I have so many responsibilities that it was impossible for me to supervise and monitor all the details of such a project," notes Chandler.

"We brought Stuart Spencer on board, and he has done a really great job of being on site and handling the literally thousands of details large and small that go into a project like this. Also plan on being flexible and remember that in some cases, in terms of your systems and procedures, you may have to create policies as you go."

Wine selection, pricing, and tasting

"Another thing I would recommend," adds Chandler, "is to have adequate data from other regions to demonstrate to local wineries that their tasting room sales will not suffer from visitor center sales. Convincing

Continued on page 92

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2001 Salary Survey correction

Median salary figures in the *PWV* Salary Survey prepared by Motto Kryla Fisher (MKF) and published in the November/December 2001 *PWV* contained a calculation error.

The tables below show the median salary figures as originally published and the revised figures, which are correctly calculated.

MKF and *PWV* regret any difficulties this error may have caused.

Median salaries

Capacity (Cases/Year)	Nov/Dec 2001 Published	Jan/Feb 2002 Correction
General Manager		
Under 7,000	$102,500	$100,000
7,000 – 25,000	141,186	63,600
25,001 – 50,000	182,500	120,002
50,001 – 150,000	175,095	148,000
Over 150,000	316,250	245,000
Winemaker		
Under 7,000	$65,000	$45,750
7,000 – 25,000	92,000	60,000
25,001 – 50,000	103,000	74,425
50,001 – 150,000	130,793	89,997
Over 150,000	182,260	126,000
Assistant Winemaker		
Under 7,000	$37,500	$38,240
7,000 – 25,000	50,000	45,000
25,001 – 50,000	67,012	44,000
50,001 – 150,000	66,550	56,250
Over 150,000	102,000	72,601
Enologist		
Under 7,000	$31,200	$31,200
7,000 – 25,000	46,750	44,500
25,001 – 50,000	39,000	39,010
50,001 – 150,000	45,040	41,900
Over 150,000	62,750	48,000
Cellar Master		
Under 7,000	$66,000	$66,000
7,000 – 25,000	39,500	38,000
25,001 – 50,000	58,750	36,000
50,001 – 150,000	68,936	50,550
Over 150,000	67,860	53,702
Cellar Worker		
Under 7,000	$28,000	$25,000
7,000 – 25,000	27,661	29,800
25,001 – 50,000	33,800	26,000
50,001 – 150,000	28,976	30,549
Over 150,000	29,725	33,000
Winery Maintenance		
Under 7,000	n/a	n/a
7,000 – 25,000	$24,000	$24,000
25,001 – 50,000	45,860	30,000
50,001 – 150,000	43,155	41,500
Over 150,000	54,375	37,883
Vineyard Manager		
Under 7,000	$45,250	$41,000
7,000 – 25,000	54,480	45,000
25,001 – 50,000	59,960	50,000
50,001 – 150,000	73,500	54,000
Over 150,000	71,750	60,000
Vineyard Worker		
Under 7,000	$25,005	$23,900
7,000 – 25,000	25,030	24,420
25,001 – 50,000	30,890	29,500
50,001 – 150,000	28,231	26,635
Over 150,000	25,497	22,240
Chief Financial Officer		
Under 7,000	$79,500	$79,500
7,000 – 25,000	81,500	87,750
25,001 – 50,000	89,000	95,000
50,001 – 150,000	117,500	105,000
Over 150,000	182,500	131,500
Controller		
Under 7,000	$77,200	$77,200
7,000 – 25,000	64,420	58,400
25,001 – 50,000	72,700	64,500
50,001 – 150,000	69,000	67,000
Over 150,000	114,000	103,000
Accountant		
Under 7,000	$54,000	$54,000
7,000 – 25,000	46,500	47,000
25,001 – 50,000	47,150	44,000
50,001 – 150,000	46,680	45,500
Over 150,000	52,640	49,400
Marketing Director		
Under 7,000	$59,750	$50,000
7,000 – 25,000	93,000	65,100
25,001 – 50,000	106,000	82,000
50,001 – 150,000	103,810	84,700
Over 150,000	170,850	129,000
Sales Representative		
Under 7,000	$36,500	$36,500
7,000 – 25,000	62,950	62,950
25,001 – 50,000	75,000	48,000
50,001 – 150,000	74,500	79,000
Over 150,000	64,375	75,000
Tasting Room Manager		
Under 7,000	$44,475	$34,000
7,000 – 25,000	56,400	38,900
25,001 – 50,000	46,175	42,000
50,001 – 150,000	41,031	36,000
Over 150,000	64,500	44,500
Tasting Room Worker		
Under 7,000	$22,070	$21,300
7,000 – 25,000	30,000	22,400
25,001 – 50,000	29,875	23,950
50,001 – 150,000	27,820	28,793
Over 150,000	28,419	26,750
Office Manager		
Under 7,000	$40,875	$39,520
7,000 – 25,000	39,175	35,000
25,001 – 50,000	47,738	40,000
50,001 – 150,000	57,500	42,220
Over 150,000	55,250	46,000
Clerical Worker		
Under 7,000	$25,990	$27,000
7,000 – 25,000	29,131	24,650
25,001 – 50,000	32,222	27,470
50,001 – 150,000	27,396	30,000
Over 150,000	30,900	30,380

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CASE STUDY

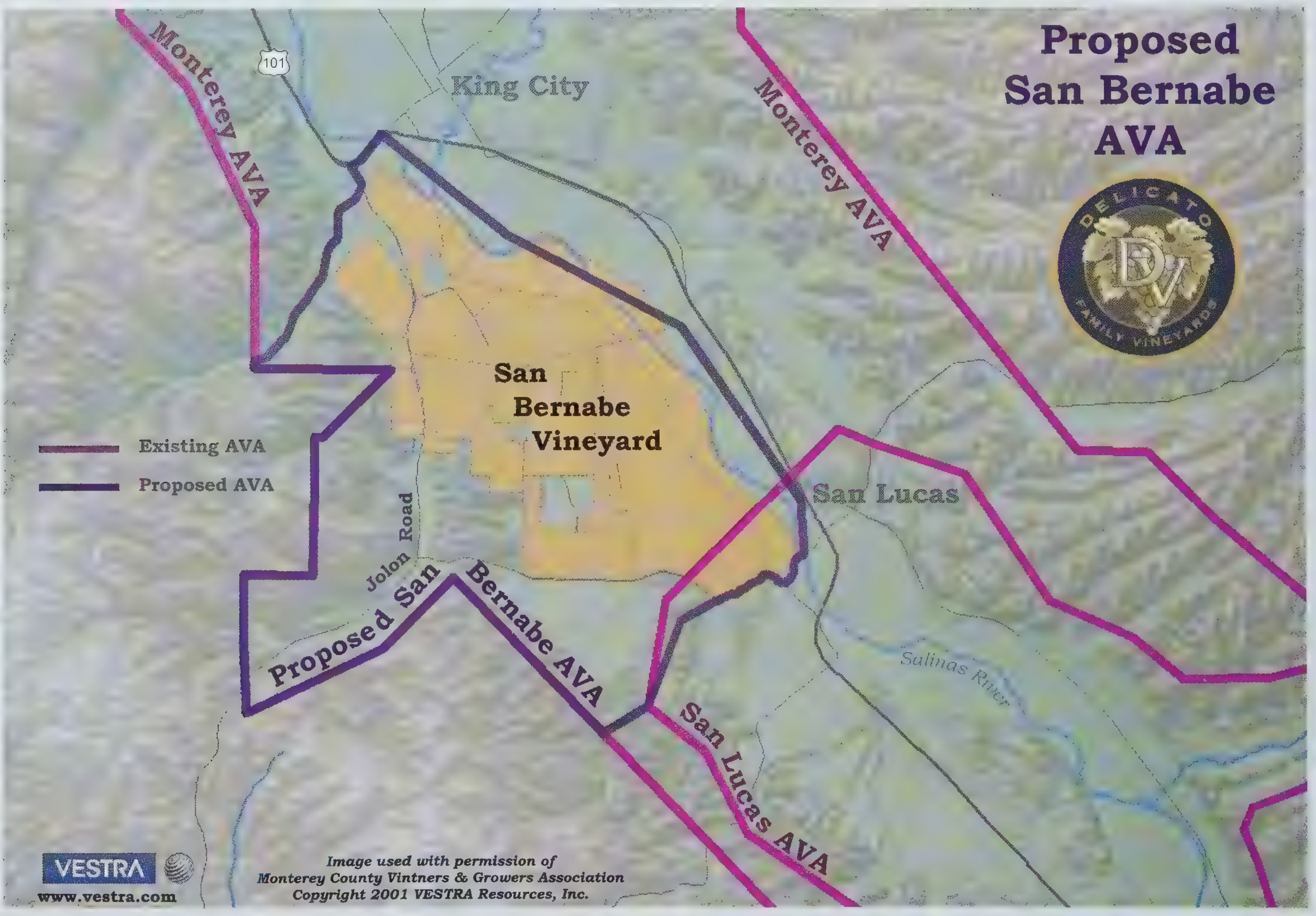
Delicato proposes San Bernabe AVA

Terrain of San Bernabe Vineyard

BY **Jamie Carothers**
VESTRA Resources, Inc.

American Viticultural Areas (AVA) are becoming increasingly important in the branding and marketing of premium wines. The Bureau of Alcohol, Tobacco, and Firearms (ATF), which assesses and approves petitions for new AVAs, reports that seven new viticultural areas were approved in the last year and six more were published for public comment.

Unlike other geographic viticultural designations or appellations around the globe, an AVA relies on winegrowers' and winemakers' skill to build a reputation for quality. There are no government regulations connecting an AVA to wine quality or farming practices.



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"At any one time," reports Nancy Sutton, Regulations Division specialist with ATF in San Francisco, "there may be as many as a dozen AVA applications in process. The number of viticultural area petitions appears to be increasing with the focus on smaller areas."

In April 2001, Delicato Vineyards (Manteca, CA) submitted a petition to ATF proposing a new AVA called San Bernabe on the central coast of California. Filing for a new AVA can be complicated, but with ATF's willing assistance, it's not difficult. Learning about Delicato's experience and use of new techniques recently approved by the ATF may help others navigate even more easily through the application process.

Delicato's motivation

Delicato began by putting together a team to develop and submit the petition and work with ATF representatives through the process. COO Claude Hoover and chief winemaker Tom Smith prepared the petition, and VESTRA Resources (Redding, CA) prepared maps of the proposed AVA at Delicato's direction. VESTRA is a geographic information system (GIS) consulting firm, that provides accurate AVA maps in digital and hard copy formats.

If approved, San Bernabe AVA will encompass 24,796 acres, including Delicato's 12,000-acre San Bernabe Vineyard, the largest contiguous vineyard in the world under private ownership by a single entity.

San Bernabe Vineyard is also the most diverse single vineyard in the world with 22 distinct micro-climates and more than 170 vineyard blocks, which are farmed individually. It has an impressive list of winery customers and is known as a "sweet spot" for Merlot and Syrah within Monterey County.

The map in Figure I shows the AVA boundary as proposed and location of San Bernabe Vineyard in relation to surrounding AVAs, Monterey, San Lucas, and Central Coast.

With several AVAs available to affiliate with, including Central Coast, Monterey County, and Monterey, why did Delicato go to the trouble of defining a new one?

"Obtaining an AVA for this region," explains Hoover, "is a major part of Delicato's strategy to 'put San Bernabe on the map.' By this, I mean that San Bernabe Vineyard has always been a magnificent property, and the Indelicato family has invested more than $100 million in acquiring and redeveloping it since 1988. However, despite San Bernabe's numerous winery customers, it has been nearly invisible from a consumer perspective.

"Our goal is to promote the high quality and distinction that exist at San Bernabe Vineyard and give consumers appropriate information about the grapes and wines that will build enduring consumer loyalty. We are investing heavily in building brands owned by Delicato, but also working with other ultra-premium wineries to cross-promote their wines made with San Bernabe Vineyard grapes. We have sought to feature some of our winery

---

Jamie Carothers, ag marketing and AVA map product director, is the primary contact for VESTRA Resources' agricultural and vineyard clients. She also oversees production and sales of VESTRA's American Viticltural Area maps and the VESTRA Multi-Spectral Imagery Program. Contact her by email at jamie@vestra.com

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customers, as well as provide useful and interesting information about our existing vineyard on our vineyard website, www.sanbernabe.com.

"In the future, we envision having several artisan wineries along the Jolon corridor, within the proposed San Bernabe AVA, that will bring even greater consumer awareness and distinction to the area."

How to propose a new AVA

The requirements for successfully proposing a new American Viticultural Area are contained in the ATF regulation 27 CFR 9.3(b) (see sidebar). Essentially, the petitioner must provide evidence that the proposed AVA has an appropriate name, that its boundaries are clearly defined, that it has distinguishing geographical features, and that the area referred to can be identified on U.S. Geological Survey maps. (Largest applicable scale means most detailed, usually 1:24,000 map scale.)

Any interested party can petition for a new AVA, but before doing so, you may wish to contact the ATF for direction and advice (San Francisco office: 415/947-5192; Washington, D.C. office: 202/927-8210). This simple step can save considerable time and effort. ATF specialists can help identify potential problems and offer suggestions to improve the petition's likelihood of success. Plus, their services are free.

Work with ATF before filing

Before submitting Delicato's application, the team met at the ATF San Francisco office with Nancy Sutton to review the petition to make sure the information was complete and that the maps of the proposed AVA were clear. VESTRA had prepared digital maps and e-mailed them to Sutton for review and orientation prior to the meeting.

Sutton reviewed the petition and hard copy maps and suggested areas in the petition that needed more information and supporting documentation. "You can minimize delays in moving the petition through the process by communicating with ATF," advises Sutton, "submitting a complete AVA petition package addressing all five requirements (see sidebar), and promptly responding to ATF's requests for additional information or evidence."

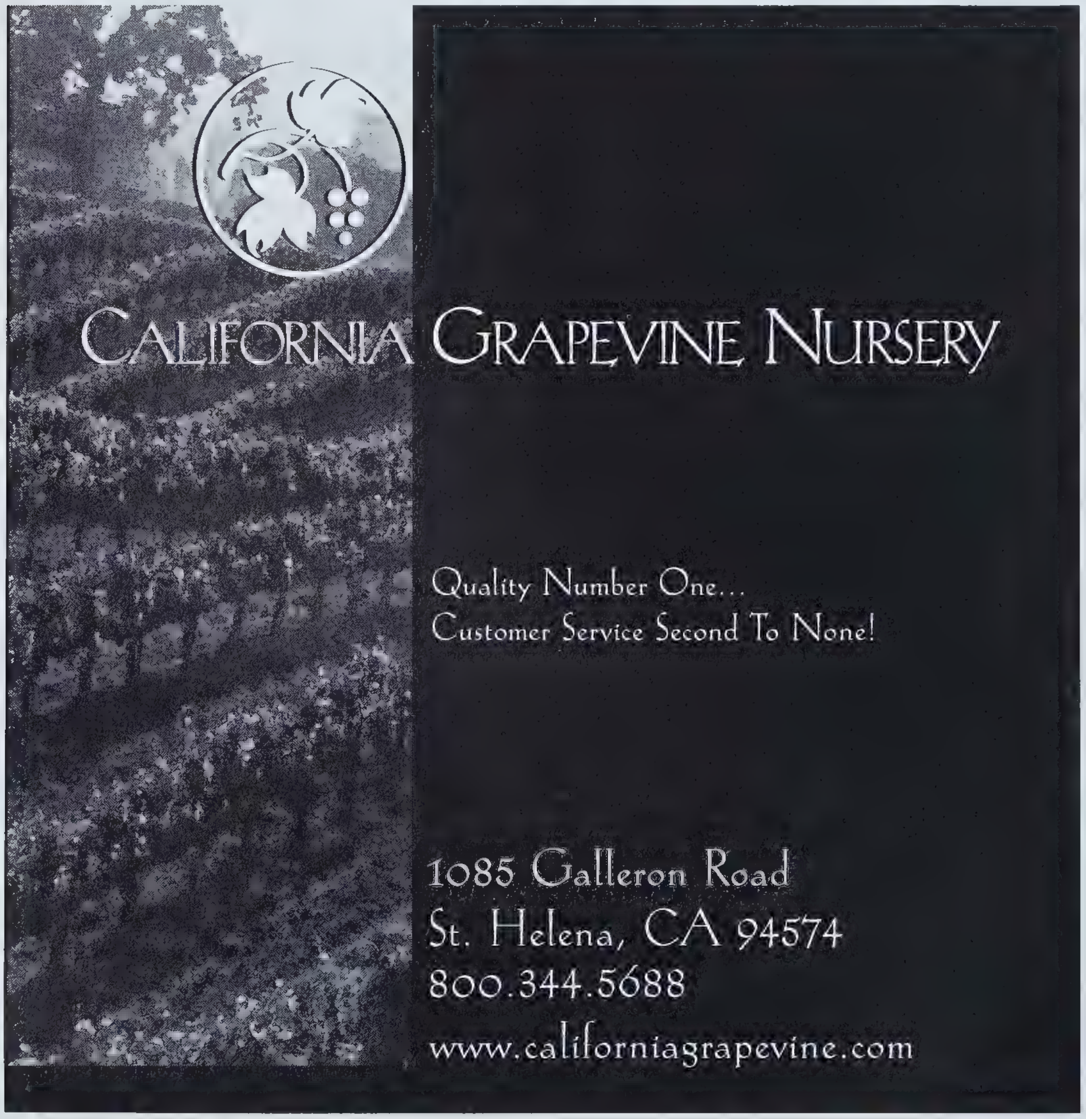
Though meetings with ATF help prevent delays, approving a new AVA takes time. "Petitioning for an

Regulation and web addresses

*AVA Application Requirements 27 CFR 9.3(b)**

1. Evidence that the name of the viticultural area is locally and/or nationally known as referring to the area specified in the application;
2. Historical or current evidence that the boundaries of the viticultural area are as specified in the application;
3. Evidence relating to the geographical features (climate, soil, elevation, physical features, and the like) that distinguish the viticultural features of the proposed area from surrounding areas;
4. The specific boundaries of the viticultural area, based on features that can be found on United States Geological Survey (U.S.G.S.) maps of the largest applicable scale; and
5. A copy of the appropriate U.S.G.S. map(s) with the boundaries prominently marked.

*Available to download from the ATF website at http://www.atf.treas.gov/regulations/27cfr9.pdf.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AVA is a lengthy process with no minimum or maximum times," notes Sutton. "Count on a **minimum of 18 months** from petition submission to final approval. It may take substantially longer, or possibly a little less, depending on the completeness of the petition submitted, the area being petitioned, and any controversy generated."

Sutton's initial suggestions to Delicato included both technical and documentary items. She asked that the petitioners provide greater clarification of the characteristics that distinguish San Bernabe from neighboring areas, as well as mapping and acreage details. She also asked the team to address the overlap of the proposed AVA with the northern boundary of the existing San Lucas AVA.

In subsequent contact between Hoover and Sutton, the issue of modifying the existing San Lucas AVA was discussed in much greater detail. VESTRA provided support by mapping precise overlays showing exactly where various boundary lines existed and by determining legal descriptions and acreage details for multiple area plots. Delicato will file a petition to change the San Lucas AVA boundary, in order to make the boundary line congruent.

VESTRA digital maps versus USGS paper maps

The digital maps VESTRA prepared and e-mailed to Sutton for comment have been an important, quick communication tool in Delicato's petition effort. They easily illustrate the adjacent boundaries of existing Monterey and San Lucas AVAs and have helped Delicato make its proposal clear.

VESTRA used its proprietary digital boundary files of California AVAs to help assure that the proposed boundaries of the San Bernabe AVA were congruent with existing AVAs. In the proposed AVA, there is an overlap with the San Lucas AVA.

In response to a letter from VESTRA, the ATF will now accept the use of digital USGS maps in support of AVA petitions. The digital files must match hard copy USGS maps referred to in the petition, along with several other requirements.

This new policy allows a petitioner to deliver maps showing existing AVA boundaries in relation to proposed AVA boundaries, and the digital format allows a version that can be e-mailed. The e-mailed version of a proposed AVA cannot be used to satisfy ATF regulations at this time; however, it can be helpful as a supporting document or as a pre-petition communication tool.

VESTRA has worked with Delicato's vineyard management firm, Coastal Valley Management (CVM) to build a Geographic Information System (GIS) for the San Bernabe Vineyard property and has taught

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CVM and Delicato staff how to use ESRI's ArcView GIS software.

This San Bernabe Vineyard GIS data was used in the proposed AVA map-building process, and ArcView was used in mapping the proposed AVA along with digital USGS 7.5-minute quad maps (largest scale referred to in the regulation).

Highlights of the Delicato petition

You can see the complete Delicato AVA proposal, as submitted to ATF, in a digital format with a view of the boundary on a background of four merged USGS 7.5-minute quad maps at www.sanbernabe.com

As the ATF regulations emphasize, a proposed AVA must be distinguishable from the surrounding area. The Delicato team prepared the story of the distinguishable and distinct features of the proposed San Bernabe AVA, and Smith and Hoover described the special sense of place illustrated by land history, soil, geology, water quality, and weather. Here are a few highlights from the petition submitted to ATF.

Land History

The name San Bernabe has a history reaching back to 1776 and the early days of the Spanish settlement in the colony of Monterey, which included what is now Monterey, CA. An early ranch in that colony was Canada de San Bernabe, later known as San Bernabe Rancho. Supporting the Delicato proposal, the name San Bernabe is shown on two of the four USGS quad maps used to map the proposed San Bernabe AVA boundary.

Soil

The area of the proposed San Bernabe AVA has distinctive soils, distinguishable from the surrounding vineyards and from other Monterey County soils. As presented in the petition, the soils of the proposed AVA are predominantly Eolian soils, derived from wind-formed dunes (63% Eolian dune soil, and 35% Oceano loamy soil). These soils are highly permeable and well-drained allowing the vineyard managers to employ regulated drip irrigation.

Climate

Climate also distinguishes the proposed San Bernabe AVA from its neighboring AVAs. A climatic region III, the proposed AVA is cooler than the San Lucas AVA to the south, a climatic region IV, due to marine influences from Monterey Bay from which cool winds blow southward in the Salinas Valley.

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Water Quality

Another unique factor in the San Bernabe story is water quality. The water source for the irrigated vines of San Bernabe Vineyard is wells adjacent to the Salinas River, which provide low levels of carbonates and nitrates. This water chemistry is an excellent component for growing premium winegrapes.

The petition for the proposed San Bernabe AVA states, "The water of the proposed AVA is quite pure and has low levels of carbonates and nitrates, conditions that are beneficial to grapevines as well as soils. Low carbonates help maintain soil permeability and access to soil nutrients. High nitrate levels promote excess vigor, which could lead to color loss and vegetal/herbal flavors in red grapes and wines."

"The water source for San Bernabe is of drinking quality," reports Bill Petrovic, San Bernabe vineyard manager. "This is wonderful for growing grapes, as it is 'soft' water, very low in salts and minerals [nitrates, less than 9mg per liter; chlorides, less than 82mg per liter] that exist in many other parts of Monterey County."

Not a speed race

A petition for a new AVA is not a speed race, and the Delicato Vineyards team may yet have bridges to cross in getting this petition approved, even with their careful, thorough approach. So far, there have been no objections to the proposal, which is very good news; controversy can slow the process to a crawl. If all goes well, however, the team expects the AVA could be approved in the fall of 2002.

According to Hoover, team members have personally contacted all of the owners of property within the proposed San Bernabe AVA and have received support for pursuing the designation. They also spoke with major vineyard owners in neighboring areas outside of the proposed AVA, all of whom expressed support for Delicato's petition.

What's next?

Now it's just a matter of waiting and responding to any questions the ATF or others may raise. The Delicato team is convinced that the time and effort will prove well worth it when they're able to proudly add San Bernabe as an official AVA to their wine label. ■

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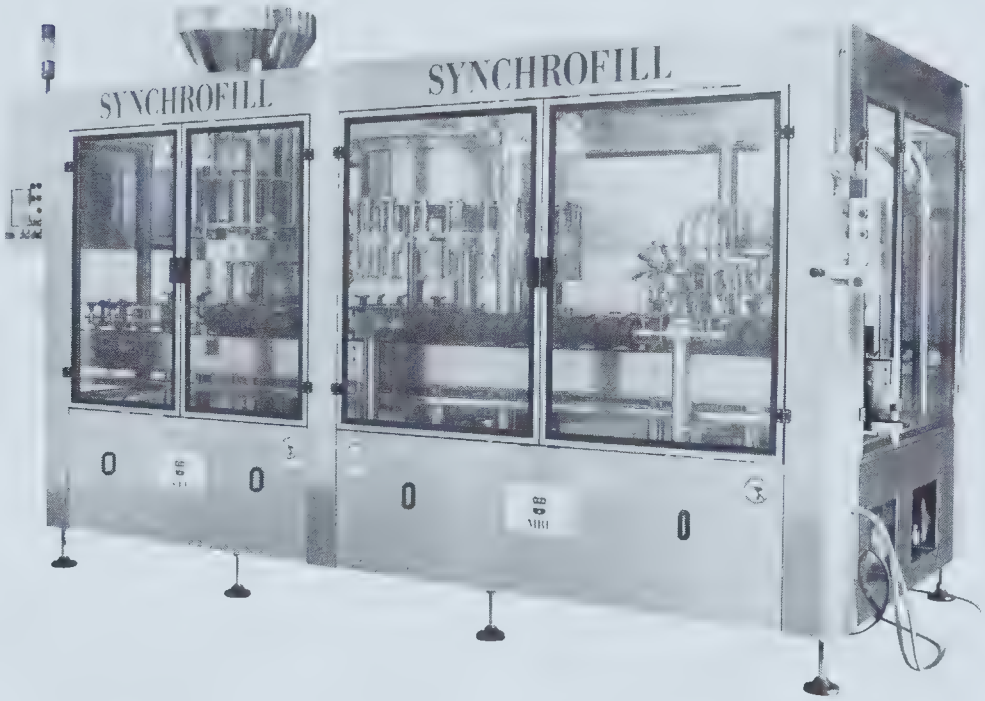

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VARIETAL REVIEW

FINE-TUNING Syrah

BY Eleanor & Ray Heald
Contributing editors

As the French have claimed all along, Syrah is of French origin. Carole Meredith (University of California, Davis, grape DNA expert), in conjunction with Jean-Michel Boursiquot (L'École Nationale Superiore Agronomique de Montpellier), formally announced the proud parents of Syrah as Dureza and Mondeuse Blanche at the American Society of Enology & Viticulture Annual Meeting in June 2001.

For centuries, Syrah has been grown and vinified differently in France's northern Rhône Valley, considered a cooler growing region, than in the south. Grapegrowers and winemakers from the West Coast of the U.S. interviewed by *PWV* are now taking a serious look at climate considerations, among a number of other aspects, as a major factor in determining growing and production excellence.

"One of the fascinating things about Syrah," says Stags' Leap Winery winemaker Robert Brittan, "is that it's so flexible and makes great wine in a broad spectrum of climates. It comes down to the style of wine that each winery desires to make."

"The whole concept of whether Syrah is grown in a cooler or warmer climate is extremely germane. More than Cabernet Sauvignon or Chardonnay, Syrah exhibits different characteristics depending on where it's grown."

> *One of the fascinating things about Syrah, is that it's so flexible and makes great wine in a broad spectrum of climates.*
>
> Robert Brittan

Clones and environment, single sites

At R.H. Phillips, most Syrah plantings are Clone 1 (Australian origin), with lesser amounts of Clone 6 (different heat treatment of Clone 1) and Noir (considered another name for the Estrella Clone, selected out of the Joseph Phelps Vineyard and sometimes referred to as "Phelps Noir"). Plantings are on 110R rootstock, on hills and slopes with shallow clay-loam soil.

Winemaker Barry Bergman explains that Clone 1 was the only choice when the vineyard was first planted in the early 1990s. "We much prefer Clone 6 and Noir that came into full production in 1999, for their improved color intensity, tannin structure, and significantly better wines," he notes.

Also planted at R.H. Phillips are ENTAV-INRA Syrah Clones that will bear a first crop in 2002.

For Justin Winery on the cooler west side of Paso Robles, the Estrella Clone is own-rooted and the Beaucastel Clone 99 is on 110R and 140R. "When I came to Justin four years ago, the Estrella Clone was not producing an interesting wine," winemaker Jeff Branco reports. "The wine was somewhat weedy and lacked personality. But that was related to yields.

"Once yields on 12x6 spacing were controlled to 9.5 to 10 lbs/vine or 3.5 tons/acre (TPA) through better canopy and water management, the finer peppery, spicy qualities of Syrah, as exhibited in the northern Rhône, became apparent.

"Picked at similar maturity levels, Beaucastel Clone 99 is more fruit-driven with greater structure under the same basic viticultural practices and yields. However, I believe the choice of 140R rootstock for some of the plantings was a mistake, because those vines are still too vigorous. Due to the location, we need rootstocks with extreme lime tolerance, and better balance is achieved with 110R. I also believe 1103P would work well."

In the cool Carneros climate, Havens Wine Cellars sources the Estrella selection from Hudson Vineyard. Average vine age is 11 years with yields of 6 lbs/vine (4x8 spacing, 1,428 vines/acre). Hudson Vineyard manager Jason Kesner notes that the Estrella selection is planted in two different blocks. In a clay bed on 5C rootstock, substantial berry size is noted. In Block T-East, from which a Hudson Vineyard designate is made, vines are on 101-14 in fairly light (for Carneros), gravelly-loam soils.

Kesner believes differences with the same clone are based on site. In clay, the Estrella Clone comes across earthy and deep-toned. In gravelly-loam, it exhibits high-end notes, pepper, and spice.

Michael Havens explains that at his winery's vineyard, the Estrella Clone is planted side by side, in virtually the same soil, with the Noir Clone on the same rootstock. The Noir selection yields bigger clusters and bigger berries. With little difference in vegetation, Estrella produces smaller berries.

Coming into bearing in harvest 2002 from a cool site are Haven's plantings of new ENTAV-INRA Syrah Clones.

Meridian's Syrah vineyards are located off Highway 46E in Paso Robles, CA, in a warm Region III with an average summer high of 92°F. Yet it is possible to have a 55°F temperature swing between the daytime high and nighttime low.

Beaulieu Vineyard®

Vineyard manager Tony Domingos explains that all plantings are the Estrella Clone on 5C rootstock, planted 10x6. Soils are shallow with root zones in the top 18 inches above a heavy limestone layer. Post bloom, shoots are thinned to two per spur. Crop loads average 5 to 6 TPA and ripen to 24.5° to 25° Brix, in early to mid-September; about the same time as Merlot does in the region.

Domingos notes that Meridian's newer plantings of Syrah are also 10x6. "For us," he says, "this is the ideal spacing because without hedging, the vines are in balance. Once veraison starts, there is no more vegetative growth. Yearly, we tend to ripen the crop in the first 10% of all the grapes in Paso Robles."

Clones and environment, multiple sites

Beaulieu Vineyard has selected different Syrah clones depending on climate. For its cooler climate Carneros vineyard, the choice is Espiguette (also known as Estrella) on 3309 rootstock, and at the warmer Larkmead Vineyard in Calistoga, it's 2PY391452, a Joseph Phelps Syrah selection originally from Christian Brothers on 5C.

Because they are in reasonable proximity to the Napa River, winemaker Bob Masyczek says the Calistoga soils are deep. "Because we don't have different clones planted side by side, it's difficult to separate environmental from clonal impact," he believes. "The biggest challenge we have in Calistoga is vigor. Deficit irrigation and native grass cover crops are required to reduce vigor. Generally, we don't irrigate.

"We crop Syrah heavy at 9 to 10 TPA in Calistoga and drop about 50% at veraison, to yield 4 to 5 TPA. If we drop crop too early, vigor takes off.

"In Carneros, the rooting zone is only a couple of feet deep, so vigor is not nearly as great a problem. The site does not require irrigation. The challenge is achieving ripeness in a cooler area. This is the last fruit to come into the winery each year in late October.

"We prune for 8 TPA and, at veraison, drop crop to yield 4 to 5 TPA. The sugars for Syrah in this area, more than any other variety, are a much lower indication of ripeness. If we can achieve 23.5° Brix, we get ripe characters. Syrah grown in Calistoga is picked in the first third of the harvest period. So, there's at least a month's separation in harvest date between this vineyard and Carneros."

Syrah for Stags' Leap Winery is grown in three locations, one which Brittan describes as a "rock pile in

PARTICIPATING PRODUCERS:

Robert Masyczek, winemaker
Joel Butler, MW,
education & press relations
national manager
Beaulieu Vineyard
Rutherford, CA

Gordon Hill, winemaker
Columbia Crest, Patterson, WA

Michael Havens
owner/winemaker
Havens Wine Cellars, Napa, CA

Jason Kesner, vineyard manager
Hudson Vineyard

Jeff Branco, winemaker
Justin Winery & Vineyard,
Paso Robles, CA

Signe Zoller, winemaker
Tony Domingos, vineyard manager
Meridian Vineyards
Paso Robles, CA

Barry Bergman, winemaker
R.H. Phillips, Esparto, CA

Robert Brittan, winemaker
Stags' Leap Winery, Napa, CA

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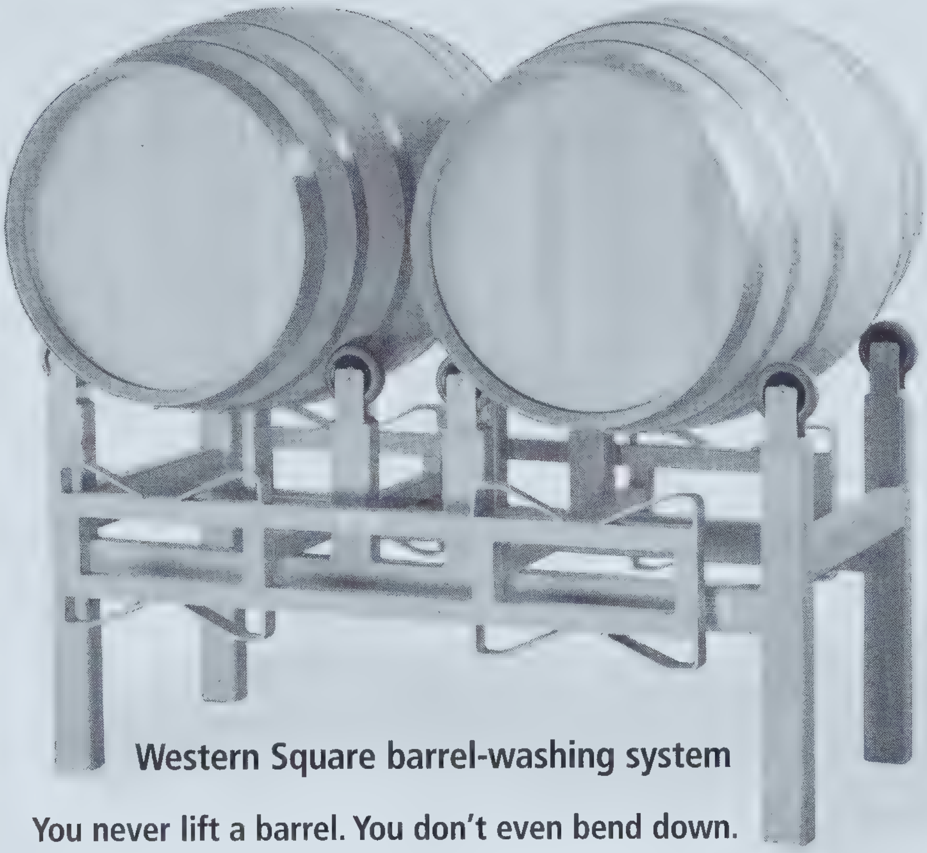

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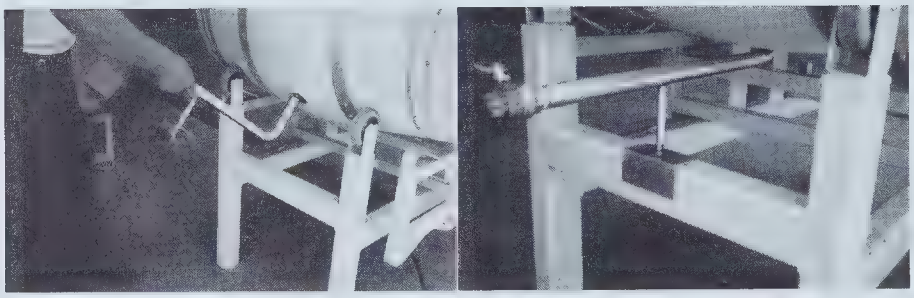

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Calistoga," another at the winery location along the Silverado Trail in Napa, and Brittan's personal ranch at the northwest corner of the town of Napa. The winery has only recently planted Syrah in Carneros.

Based on soil structure and water retention capability in the various vineyards, rootstock is principally 101-14, but in some spots, 1103, 110R, and 420A were chosen. "We'd like to make all the vineyards non-irrigated, but at this point, we are unable to because the vines are not old enough," Brittan explains.

STAGS' LEAP WINERY

Stags' Leap

"There's also the problem with Syrah's tendency to shrivel, and we know that a little water near the end of the growing season is an aid. The only rootstock on which Syrah does not shrivel is 1103, but it's so vigorous, it is impractical for Syrah on most sites.

> *There's also the problem with Syrah's tendency to shrivel, and we know that a little water near the end of the growing season is an aid.* Robert Brittan

"Most people would consider Napa a fairly cool area, yet I consider it moderately cool. Stags Leap District is a warm area, though it gets significant temperature swings. It is possibly too

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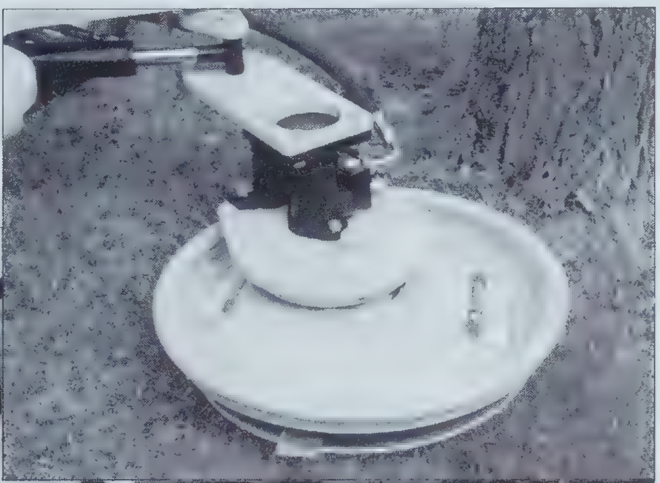

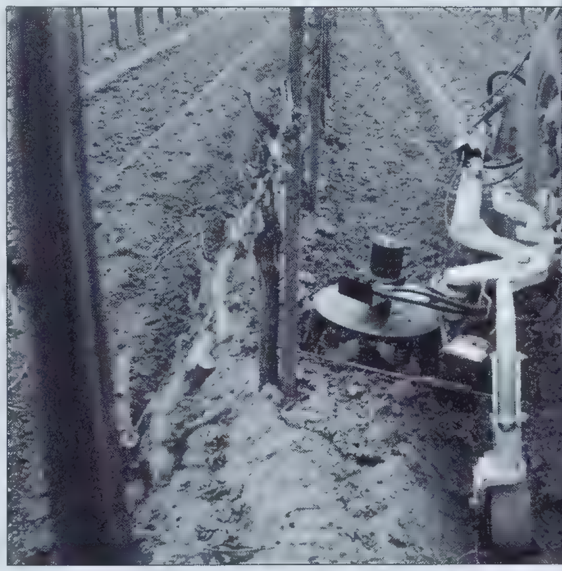

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warm for Syrah. Independent of clonal selection, I'm convinced that, for the flavor and structure I want to achieve with this variety, it lends itself better to a cooler area than Stags Leap District."

> *Water management and crop level are key to great Syrah.* Bob Masyczek

Brittan sources not only from a number of sites, but different clonal selections. The most interesting to him based on origin, but the least interesting in terms of wine, are selections he made out of the original Stags' Leap Winery Petite Sirah block, dating back to the early 1900s and possibly to the 1800s. Because of its characteristics, he believes that the original planting was made as a block of mixed southern Rhône varieties. This plant material was moved at least once, if not twice, before it came to its current location.

Two other selections grown at Brittan's ranch, a cooler location gravel patch, are believed to be Shiraz from Australia, one out of the Jackson Vineyard Collection. He also has Clones 99, 101, Beaucastel, and Estrella. Of these, Brittan prefers Clone 99 rather than Estrella.

"On all of the sites, the biggest problem is vigor," Brittan contends. "And it's true for all of the clones. There's variation in berry size and cluster shape, but the most important aspect is that 5 TPA is pushing the absolute limit on yield to obtain fruit quality and mouth structure in the wine.

"When I say this, I know I should be talking about pounds per vine, but for Shiraz, it's probably more like pounds per shoot, and dependent on site.

> *I should be talking about pounds per vine, but for Shiraz, it's probably more like pounds per shoot.*
>
> Robert Brittan

"But the real question is where we end up at harvest. We've looked at different rootstocks and exposures; then meticulously shoot-thin twice (prior and post bloom), leaf pull, and hedge once, three weeks after fruit set. We also employ water deficit irrigation as a means of controlling crop. All we've really experienced so far is pretty good sunburn. Planting is north-south, and if I had it to do over again, I'd run the rows east-west."

COLUMBIA·CREST

Columbia Crest Syrah is grown throughout the Columbia River region in Washington. Winemaker Gordon Hill explains that some vineyards are low Region III, but in a good growing season, these sites might reach mid-Region III numbers. Others are Region II or high Region II.

Columbia Crest made its first own-rooted Syrah plantings in a cool area with sandy-loam soil in 1994. Washington state now has over 2,000 acres planted with what is believed to be the Estrella Clone.

"Such numbers indicate that Washington is in a discovery period, and we don't know yet how some vineyards will respond," Hill acknowledges. "Some of the plantings are in areas where there have never been winegrapes."

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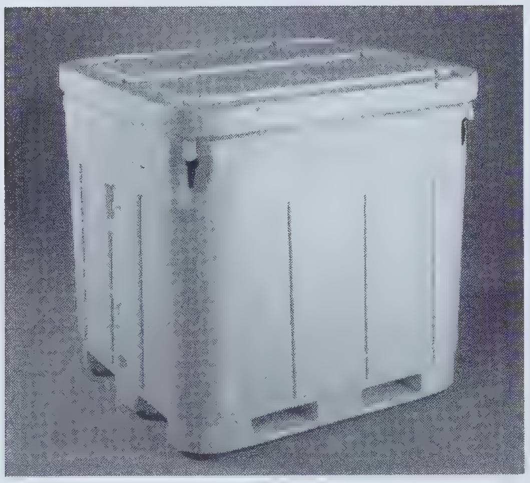

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Water management is key

In 2000, Havens tried to control vigor by not watering through bloom, and the Napa region got hit by a record two-day heat spell with a 114°F peak temperature. It caused a 3% to 5% crop loss. "Which would have been OK," Havens says, "if it just shriveled the berries a bit. But it baked the skins and as the berries kept enlarging, they split.

Sometimes, it's not only the heat, but a north wind, Kesner suggests. The vineyard turns into a convection oven with only 15% humidity at 9 AM.

Tony Domingos adds that once this happens, or Syrah berries are sunburned, they remain pink, never darken, and negatively impact wine quality.

Havens has come 180° on the issue of watering. "You need to keep the vines alive," he stresses. "Metabolism must be maintained or the result is dehydration — raisins with green tannins and a high-alcohol, ugly wine."

> *Metabolism must be maintained or the result is dehydration — raisins with green tannins and a high-alcohol, ugly wine.*
>
> Michael Havens

Brittan maintains he is not a big proponent of vigorous leaf pulling, especially in a vineyard that's a wind tunnel. Pulling leaves slows down maturity.

Beaulieu vineyards are leafed only on the morning side. "But with water, we're still seeing tendrils late in the season," Masyczek says. "So if the vines don't look like they need water, we don't irrigate. Water management and crop level are key to great Syrah. Sugar accumulation by dehydration without flavor development *is not the way to go."*

Phenolic maturity

"What we all desire," Havens maintains, "is to harvest at the point in the ripening trajectory with desired flavors and the balance of sugar, acid, pH, and phenolic ripeness.

"If the ripening trajectory starts out vegetative to herbal, then on to spicy, fruity, and jammy, the next step is cooked. Each winemaker needs to figure out where in the wine's development flavors are most desirable. Rob [Brittan] alluded to this as a stylistic choice. Personally, at Havens, we like spicy — white pepper, lavender, orchids, highly aromatic, and elegant-in-the-mouth wine.

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"If fruit gets too ripe, those characteristics are lost. And how does fruit get too ripe? It could be growing Syrah where it is too warm or letting the fruit ripen too much wherever it is grown. There's no right or wrong; it's a choice."

Havens has attempted to use some maturity analysis by Andrew Waterhouse (UC Davis), but finds it too slow for the decisions a vintner needs to make. "These are two-day tests for a decision I have to make almost immediately," he contends. "There are some other methods in research now, utilizing color spectrophotometry, which take only as long as sugar analysis."

On specific blocks, in an attempt to judge tannin maturity by tasting the juice at various periods of development, Branco picked grapes from as low as 24.2° Brix to as high as 26.5° Brix. He combined this with tasting skins and chewing on brown seeds to evaluate maturity evolution from crunchy green to softer, more supple tannins.

"This may not be the most scientific way to learn how various blocks develop in a vineyard, but it is practical," Branco explains. "It is empirical, and if one randomizes the sampling, a good assessment of flavor and tannin development in various sites is possible."

Havens agrees, adding, "To judge maturity, there is no substitute for tasting."

Other considerations

On a site with high vigor, Masyczek notes that there needs to be a lot of "wood" to devigorate vines. That's either created by a split canopy or a fairly long cordon. Significant weight per vine will be carried. On less vigorous sites, spacing will be closer with a lower yield per vine.

In the main, these participants employ Vertical Shoot Position (VSP) trellising and adjust the canopy as needed to suit the site.

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R.H. Phillips, however, favors Smart-Dyson as a way to distribute the vigor of Syrah planted 6x8. "We utilize Smart-Dyson, with about six feet of cordon on a number of varieties," Bergman reports, "but Syrah offers the best success. VSP is preferred for a number of reasons, but with a high-vigor variety like Syrah, it does not give us the desired effects. We typically spur-prune vines, but are now experimenting with cane pruning."

Hill notes that the Columbia Crest spacing is either 9x6 or 8x5, and spacing is not a major concern in Washington. With only six to eight inches of rainfall per year, water issues are paramount. Soils are sandy — like sand dunes. Deficit irrigation is the main form of canopy management.

In the grand scheme of things, then, what are the most important aspects needed to control vigor? Clones, rootstocks, soil, climate? What exactly?

Branco believes that for proper rootstock selection, soil is important. Hill suggests aspect.

Joel Butler (Beaulieu) asks: Provided that soil is compatible, does it make sense that denser plantings are best on cooler sites?

> *We typically spur-prune vines, but are now experimenting with cane pruning.* Barry Bergman

"If the climate is cooler," Branco responds, "the sunlight is less intense throughout the growing season and the crop load per vine cannot be as heavy. Therefore, to have a commercially viable production, more vines per acre are required.

"Paso Robles, however, is an extremely forgiving climate for greed, poor vineyard management, or whatever accounts for large crop loads. There's so much sunlight in the region that if desired, a grower can ripen a lot of fruit. However, once that's done, the best characters of any grape variety are lost."

Even with all the sunlight in Paso Robles, Meridian winemaker Signe Zoller says that developing optimal color for Syrah is a regional challenge. Since she correlates quality with color, this is a significant issue for her.

Zoller notes that particularly on 5C rootstock, it is difficult to regulate irrigation to yield clusters with small berries. One Meridian grower does mechanical pre-pruning and follows up with hand crews for clean up. At crop yields of 8 TPA, this technique promotes more clusters with smaller berry size, offering more deeply-colored juice.

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"When a grower manipulates berry size, cluster size, and the number of clusters, the anthocyanin/tannin ratio changes," Havens says. "Most anthocyanins are derived from the skins, and if there are more berries, there's more skin per volume of juice. That ratio easily changes desired characteristics of the varietal."

> *When a grower manipulates berry size, cluster size, and the number of clusters, the anthocyanin/tannin ratio changes.* Michael Havens

Brittan adds that the trade-off is immature grape seeds. He opts for seed maturity with a smaller number of clusters per vine.

Prefermentation techniques

Only Beaulieu and Columbia Crest use a small amount of whole berries. Most interviewed producers are crushing Syrah.

Using a Vaslin destemmer with grapes from a large vineyard, Masyczek experimented with rollers moved away compared to rollers in place. "With the fruit we're sourcing, and independent of whether they're from a warm or cool site" he says, "we believe we are getting excessive tannins when the rollers are in place.

"The must pump line is fairly long and the fruit gets enough disruption on the way to the tank. We probably get about 20% whole berries, and that's fine. We're not concerned about extraction, but we are concerned about tannins."

Butler notes that this practice is traditional in the Northern Rhône. Recently, a number of producers there are opting for whole clusters.

During fermentation

To manage the cap at Beaulieu, a sprinkler is used twice daily. Once a day, half the tank is drained through a sump and then manually returned over the top. "A labor issue arises with manual pumpovers," he points out. "Traditionally, we have been using sprinklers, and it has worked well to achieve good balance and color extraction.

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Equipped with a number of 2.5-ton fermentors, Hill is able to manually punch down the cap; he prefers that method.

Among participating producers, skin contact time ranges between five and 16 days, and maximum fermentation temperature between 80° to 88°F.

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Using both 5- and 10-ton fermentors, Branco prefers completing fermentation at a higher temperature, about 86° to 87°F. He then holds the tank at that temperature or as high as 90°F during post-fermentation maceration, an additional four to 12 days past dryness.

"In that time tannins keep building," Branco contends. "With sufficient time, they'll drop back down and build up a second time. Depending on the amount of time I have, I try to press after peak tannins (without any bitterness) are attained the first time. I'm not concerned about astringency; bitterness is the greater concern. If I don't catch it then, I find that I have to wait until it peaks the second time, or in the ballpark of 21 days."

Discussing warmer climate fruit, Bergman explains that he is attempting to get as much extraction during fermentation as possible with three sprinkler pumpovers per day. "My belief with R.H. Phillips fruit," he explains, "is that we need to be as aggressive as possible during fermentation, with peak temperature up to 88°F."

Hill also prefers to work the fermenting juice over hard early on. His aim is to get a soft wine with as much color and flavor as possible. He prefers to press as soon as the wine reaches 0° Brix.

Zoller's method is similar. "If we have sufficient color and can only do a couple of pumpovers each day, we can also do a rack and return to enhance color extraction."

MLF in tank or barrel

Bergman has made the commitment to complete MLF in tank. "Although," he says, "there are many good reasons to have MLF take place in new barrels for better flavors and oak integration."

The latter is preferred at Beaulieu for all reds, and therefore with Syrah, regardless of whether the fruit is sourced from a cool or warm climate.

"To get MLF going in under 20 days," Havens notes, "is unusual. If it does go, it might be the nasty bugs, so MLF in barrel is more the norm. Additionally, in the barrel, free anthocyanins bind with the tannins, which is a huge advantage for mouthfeel and color stability.

"One thing I'm trying to do now is keep the wine in tank for a short period

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after pressing, because I'm using micro-oxygenation post primary fermentation."

Brittan believes that Syrah, of all varieties, is most susceptible to sulfides, and that's why he does not transfer wine to barrel until a minimum of two to three rackings are done. That said, there are those who believe that some of the most interesting characteristics of Syrah stem from reductive reactions. "To me, these wines are just flawed," he contends.

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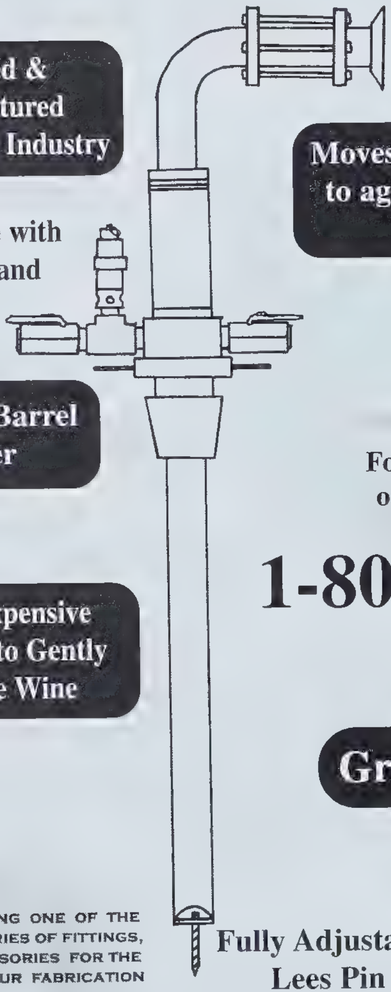

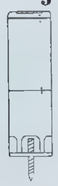

Aerative pumpovers during fermentation and maceration are ways Branco defends against development of reductive characters.

Bergman maintains that he has not encountered the reductive nature of Syrah with R.H. Phillips fruit. The EXP Syrah comes off the skins at dryness; MLF follows in tank and wine is racked as soon as it completes. Another racking is done prior to transferring wine to barrel, followed by further racking out of barrel to tank, then back to barrel every three months.

Could the sulfide problem be site-specific? Participants agree that it probably is, and may also be pH or nutrient-related.

> *Syrah does not need a lot of new oak because the fruit has so many interesting characters on its own.*
>
> Michael Havens

New oak

On average, interviewed winemakers are using a barrel mix of 20% to 33% new oak.

"You could use lots of new wood with Syrah, but why?" Havens asks. "I'm delighted to see the reasonable average new oak percentage for this group. One of the problems that I'm seeing with California Syrah is too much new oak. In many cases, it's hiding the variety. Syrah does not need a lot of new oak because the fruit has so many interesting characters on its own."

"If a winemaker is going to use new oak, he/she should want to do that for a reason. It may be to build structure or to complex the wine over a longer period of time. To achieve this, a lot of new oak is unnecessary because Syrah has a very high anthocyanins/tannin ratio. Syrah does not have a lot of tannin, and that's one of its joys. When wood tannins are added from

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new barrels, it creates a major negative impact on the structure of the wine."

Brittan believes that when the grape is grown well, the structure of the wine is such that it finishes without a tannin hit. When that's confused by the use of a large percentage of new barrels, it totally changes the wine. "I'll agree that it's a stylistic element," he says. "One can choose to make wine that way, but every year, I've reduced the number of new barrels in the Stags' Leap Syrah program."

Over the last few vintages, both Brittan and Branco have moved closer to using only 10% new barrels. But they differ somewhat on their opinion about American Oak (AO). "Absolutely none," Brittan maintains.

"I find that AO works especially well for the Estrella Clone, with its spicy, gamey, peppery quality," Branco contends. "But for other clones like Beaucastel, I prefer French oak (FO)." I'm beginning to like Syrah aged in puncheons."

> *I'm beginning to like Syrah aged in puncheons.* Jeff Branco

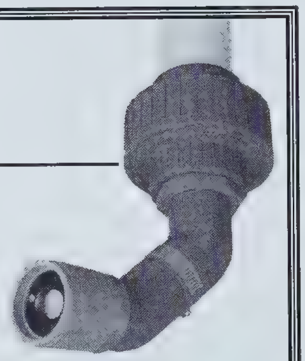
Bergman prefers AO for Syrah. "It's not the majority of the barrels, but it's a nice addition," he says. "In the early to mid-1990s, the R.H. Phillips Syrah program used all FO — and only a small percentage of that was new — for 18 to 20 months of barrel-ageing. In the late 1990s, we transitioned to 100% AO, depending on the vintage, and up to 50% is new for 12 to 14 months in barrel.

"There's certainly apparent oak in the wine, but for our fruit and our style, I like to bottle it 16 months post-vintage, while the fruit is fresh and vibrant, yet with enough butterscotch, spicy, and toasty characters from AO that match well to the fruit. The AO offers an apparent sweetness and richness. In a nutshell, our tack now is more new oak, less time in barrel."

Blending varietals

Interviewed producers use small amounts of Grenache, Viognier, Mourvèdre, and even Petite Sirah for blending.

Beaulieu has an old Grenache vineyard in Paicines (near Hollister, CA) that offers soft tannins and fresh raspberry character. "Some of our Syrah does have high tannins and the Grenache (4% to 9% of the blend) helps to round out the wine," Masyczek adds. "In blind bench trials, we always prefer the wine blended with the Grenache and sometimes Viognier, an



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aromatic variety that also reduces aggressive tannins."

For similar reasons, Branco uses up to 20% Mourvèdre. It adds another aromatic aspect to the wine. The source has raspberry-like fruit and some spiciness which enhances the gamey, white pepper notes of Syrah.

Bergman, who bottles 100% Syrah when possible, and who also has used Petite Sirah, reserves judgment on which blending varietal might be used, if any, until the final blend is made.

Ageability and climate

"Cool climate Syrah comes in with incredible color and low pH," Masyczek says. "It seems that there are more complex anthocyanins and a larger wealth of extract in the wine. I believe the ageing potential of these wines is greater. But we source from a Dry Creek Valley AVA dry-farmed vineyard which is excellent.

"The call on ageability is a tough one. If the source is a weaker warm region site, then I believe the wine will fall apart in the long term. Yet, if the wine is well-extracted from a warm region, it's going to do fine."

Branco says that, with Syrah on the West Coast, it is still too soon to discuss ageability. However, he says that if a preliminary judgment can be made from Cabernet Sauvignon, which is grown in both warm and cool climates, the future is bright. "If the extraction is there with a balanced level of tannin and acidity," he remarks, "the wine will go long-term, independent of climate."

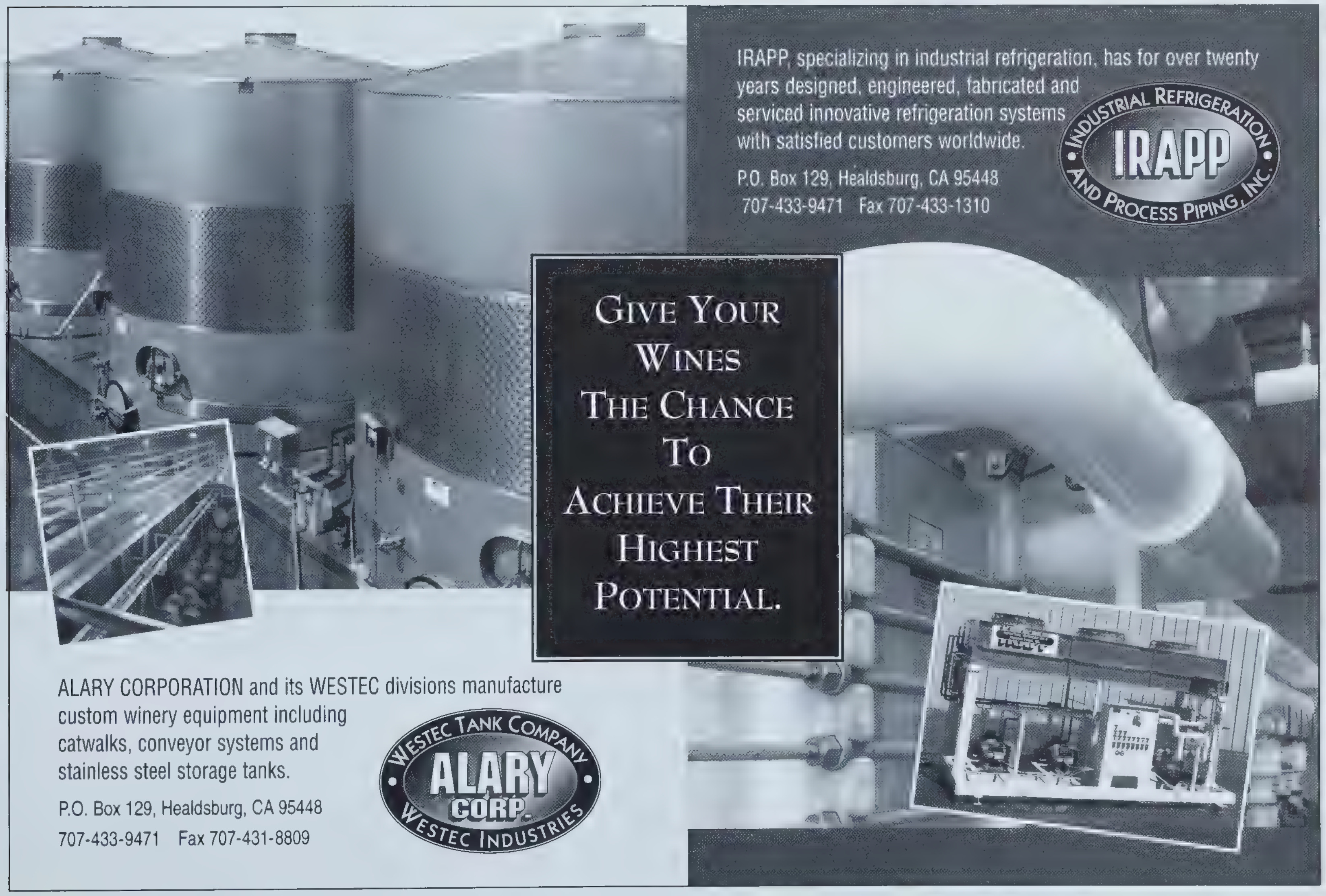
What is classic Syrah?

In Havens' opinion, Côte-Rôtie, Hermitage, Saint-Joseph, and Cornas from the Northern Rhône are classic Syrahs. If he had to pick one from the pack for the classic, it would be Côte-Rôtie.

HAVENS

"The defining characteristic of the great Northern Rhône red wines, and therefore cool climate Syrahs, is the aroma and flavor of white pepper," Havens says. "There's a lift on the back palate which, when the wine is young, can be perceived as bitterness, but what I call the 'white pepper tail.' Whether it's in the Rhône, Australia or the U.S., this character is not in wine from warmer sites.

"This does not mean that there is not excellent Syrah from warmer sites,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but if the European model is a reference point, then the white pepper element defines it."

The Northern Rhône put Syrah on the map, Brittan believes. "These are unique wines from a unique area. In addition to what Michael [Havens] said, I think there's a real structure to Syrah from the Northern Rhône. I actually prefer Hermitage because it has more flesh than a Côte-Rôtie.

"Is that the style to emulate? If I was making wines in Australia, absolutely not. Let's face it, the Australians have done a phenomenal job of flooding the world with damn high-quality, well-made Shiraz at a good price, and from an essentially warm climate.

"Where does that leave us on the West Coast or anywhere else? It's a case of what is the best and most unique Syrah you can make from your site. To me, that's the most exciting element of Syrah. Today, consumers are more educated, and they are not looking for cookie-cutter Syrahs." ■

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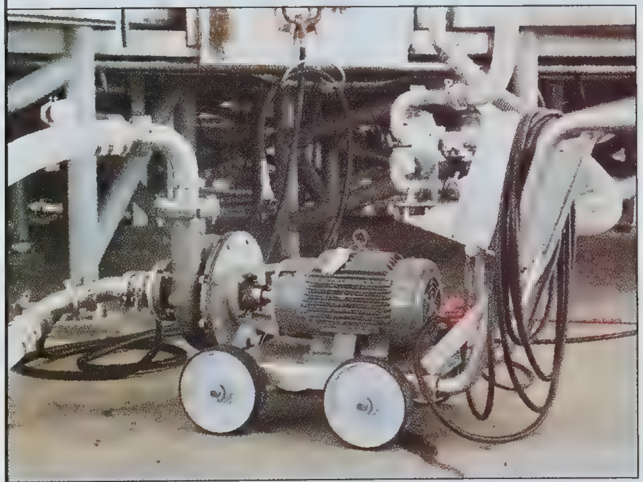

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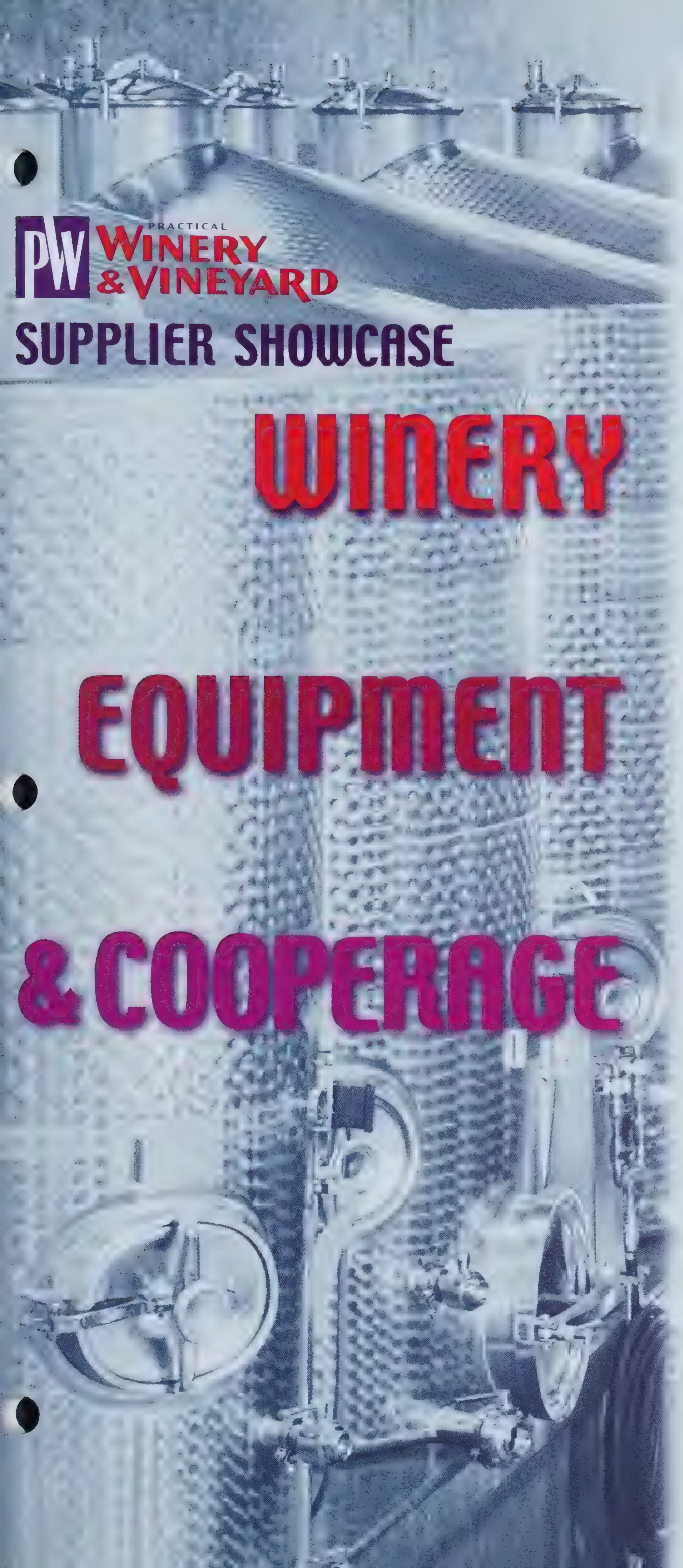

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Vaslin-Bucher equipment is adaptable to the winemaker's specific needs by offering flexibility in its use. By combining a Bucher Xpert grape press with other Vaslin-Bucher equipment, such as the Delta destemmer/crusher, winemakers have the tools required to extract high-quality juice from their grapes.

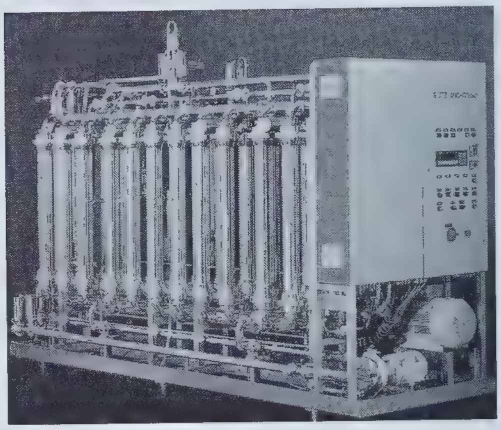
KLR Machines and Vaslin-Bucher offer the wine industry advanced technology in equipment and complete technical support.

Contact a KLR Machines sales technician at the west coast or east coast office and let them work with you to select the equipment that will suit your specific requirements.

For more information, contact:
KLR Machines, Inc.
West Coast:
350 Morris St., Ste. E, Sebastopol, CA 95472
tel: 707/823-2883; fax: 707/823-6954
East Coast:
47 West Steuben St., Bath, NY 14810
tel: 607/776-4193; fax: 607/776-9044
e-mail: klrmach@pacbell.net

PLEASE SEE KLR MACHINES' AD, PAGE 8.

SEITZSCHENK FILTER SYSTEMS



SeitzSchenk has been supplying filtration equipment and other filter products to the international wine industry for over 100 years.

SeitzSchenk has been marketing the Seitz MICROflow® crossflow filtration systems to the U.S. wine industry for the last three years after successfully establishing this technology in Europe over the past 17 years.

To date, SeitzSchenk has demonstrated that crossflow technology is an attractive alternative to traditional filtration technology, resulting in a number of units being sold to highly recognized wineries in California.

SeitzSchenk is proud of its history as a leading supplier of high-quality filtration equipment. The Seitz MICROflow® is no exception. Manufactured from the highest-quality components available, it is designed to be the gentlest wine filter available and is backed by the best warranties in the industry.

The Seitz MICROflow® offers gentle, quality-enhancing technology with no oxygen pick-up or aroma or CO_2 losses due to the Seitz AROMA protective technology. Available for semi-automatic or automatic operation, this robustly engineered system is offered for all output ranges at low operating costs.

Contact SeitzSchenk for a free, animated CD or demonstration and learn for yourself why Seitz MICROflow® crossflow filtration systems are the most desired technology for your future wine filtration.

For more information, contact:
SeitzSchenk Filter Systems
Allen Posella, North American Sales Manager
2336 Tenth St., Sanger, CA 93657
tel: 559/287-4061; fax: 559/875-2442
e-mail: aposella@usffiltration.com

UNITED BARRELS

United Barrels represents Tonnellerie Chalufour, whose barrels are known on four continents for unique spice and roast chestnut aromas. Not part of a massive cooperage chain, Chalufour prizes individual winemaker relationships. Its specialties include Jupile Forest oak (terrific for barrel ferments) and the XO Barrel, made from cooper-select, three-year, air-dried oak.

In 1997, United Barrels introduced oak alternatives from renowned Australian producer, Moxon Timbers. Customers and competitors are impressed by Moxon's ability to deliver consistent, delicious oak flavors in tank staves and chips at low prices. Moxon's "ring system" of supplier-installed, removable tank frames (inserts) is highly successful, and Moxon's Aussie engineers spend weeks in California fitting these custom tank systems.

Seeking a top-end, fire-roasted oak tank stave for the best wines, United Barrels went to Transylvania for the Romany Stave (the closest thing to a great French barrel), rich in caramel and vanilla. The Romany demonstrates that the finest winemaking results do not require paying a premium for your barrels.

United Barrel's cooper is currently in China perfecting the Dragon Barrel production process. Chinese oak has excellent flavors, and soon winemakers will be invited to explore aromatics and tannins from managed forests of the Manchurian highlands.

For more information, contact:
United Barrels
1804 Soscol Ave., Ste. 100, Napa, CA 94559
tel: 707/258-0795; fax: 707/259-5324

PLEASE SEE UNITED BARRELS' AD, PAGE 58.

VINTNERS SUPPLY COMPANY

Vintners Supply Company specializes in filtration and separation applications, representing products from proven manufacturers.

Vintners' representation includes ABEL® pumps, L.P., manufacturers of positive displacement pumps. ABEL® has introduced the new H M model hydraulic membrane pump. The H M pump is a reliable, high-pressure, filter-press feed pump and is competitively priced.

Crosible Filtration, Inc., offers the 288XK2 polyester filter media for all recessed plate filters.

Cutler Stevens Pumps offers a new stainless steel, cart-mounted centrifugal pump with a four-blade, full-open impeller.

EIMCO Process Equipment Company, formerly Baker Process, offers a full line of Shriver recessed-plate filters and EIMCO rotary-drum vacuum filters.

E*nviro*Tech Molded Products offers a full line of one-piece, injection-molded, polypropylene filter plates.

PTI Advanced Filtration, Inc., offers a wide range of micro-filtration products to meet the demands of the wine and beverage industry. PTI's new Clariflow®-Wine membrane cartridge filter is available in 0.45 and 0.65 micron-absolute ratings. The Clariflow-Wine cartridge utilizes the proven polyethersulfone membrane.

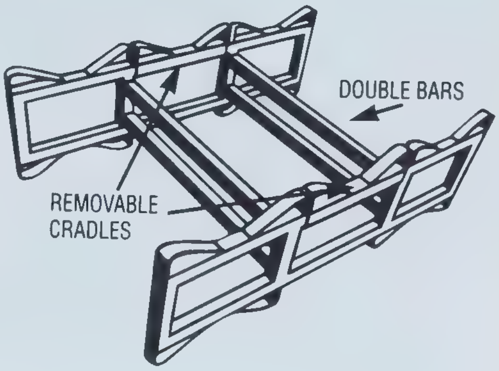
PTI has added a 0.8 micron-nominal version of the popular Clearflow® cartridge. Available in 0.2, 0.5, and 0.8 microns-nominal, this pleated, depth-media, over-polyethersulfone membrane cartridge is ideal as a pre-filter or as a final filter for wine.

AB Enzymes, formerly Röhm Enzyme, offers a full line of pectinase enzymes and has introduced ROHAVIN® CXL (liquid), a concentrated pectinase enzyme with cellulase side activity for red winemaking.

For more information, contact:
Vintners Supply Company
Robert Moeckly
PO Box 5570, Napa, CA 94581
tel: 800/366-6809; fax: 707/644-5827
e-mail: vintsup@aol.com
website: www.vintnerssupply.com

PLEASE SEE VINTNERS SUPPLY CO.'S AD, PAGE 45.

WESTERN SQUARE INDUSTRIES



Western Square is the wine industry's largest supplier of portable steel barrel racks, including stainless steel racks in the two most popular models: the double-inside bar (7-inch forklift opening) two-barrel rack and the corresponding four-barrel rack.

Offered in powder-coated mild steel are the above two models plus a low profile (4-inch forklift opening) inside bar rack, that is also a topping rack and a rack for the bottom tier of barrels, that can be pallet-jacked from all four directions.

These standard models will accommodate all barrels from 200L to 275L. Special models are also available. Regardless of which racks are used in your winery, Western Square can supply racks that will co-stack.

For those wineries still stacking barrels in pyramids, Western Square makes a cradle that replaces four chock blocks, thereby facilitating stacking.

Western Square offers two handy devices for holding a single barrel above tiers of two barrels, useful when you have an odd number of barrels in a lot. One is the previously mentioned pyramid cradle, and the other is the removable center cradle (see photo with standard two-barrel rack).

Western Square also makes a barrel-washing system specifically for use with portable racks.

For more information, contact:
Western Square Industries
1621 N. Broadway, Stockton, CA 95205
tel: 209/944-0921; fax: 209/944-0934
e-mail: info@westernsquare.com
website: www.westernsquare.com

PLEASE SEE WESTERN SQUARE'S AD, PAGE 52.

AERATION TECHNOLOGIES INTERNATIONAL, INC.

Aeration Technologies international, Inc., (ATi) is proud to offer the wine industry a state-of-the-art wastewater aerator. The ATi line of aeration equipment is readily adapted for aerated ponds, oxidation ditches, equalization basins, aerobic digesters, and gas-stripping systems. Designed by horizontal-rotor aeration experts, ATi aerators offer quality, efficiency, and longevity.

A combination of features contributes to the success of ATi aerators. ATi's Direct-Coupled Drive Assembly results in zero efficiency loss between the motor and gear-reducer. This, coupled with the high motor and gear-reducer efficiency, significantly increases applied brake HP to the rotor. ATi's proprietary, totally enclosed tail-bearing assembly protects the tail bearing from wastewater's damaging effects.

ATi | AERATEK™

The closed-cell, foam-filled floatation tanks provide a non-sinkable design that guarantees floatation setting and longevity. The stainless steel construction lasts far longer than mild steel in a corrosive wastewater environment.

Through the application of cutting-edge technology, ATi provides for larger HP unit sizes while yielding the highest oxygen transfer and mixing rates, with certified performance.

ATi aerators are economically and environmentally beneficial. Call today to find out how ATi can help you O_2ptimize™ your wastewater treatment system.

For more information, contact:

Aeration Technologies International, Inc.
Mississippi Research and Technology Park
One Research Blvd., Ste. 207
Starkville, MS 39759-8749
tel: 800/616-6222 or 662/324-0232
fax: 662/324-0141
website: www.aeratek.com

PLEASE SEE ATI'S AD, PAGE 89

CANTON COOPERAGE

Canton Cooperage believes tradition and commitment to excellence are key ingredients for producing the finest American oak barrels.

CANTON

Today, Canton's American oak wine barrel enjoys a worldwide following. The cooperage continues to break new ground with its ultra-premium Grand Cru barrel made with wood naturally seasoned for three years, and its super-premium Vintage barrel made with wood naturally seasoned for two years.

Canton is fast becoming a leading American oak cooperage for innovation and consistent quality. Canton owns four stave mills in Ohio, Kentucky, Indiana, and Tennessee that provide total control of the wood supply and a secure source of premium white oak staves and heading. Canton technology controls and records the toasting process allowing the cooper to fine-tune the taste and character of the barrel, and helps ensure the same toast level for future orders.

In 1998, Canton became a sister company of the world-renowned French cooperage Taransaud. Since then, Canton has based its quality control on its extensive experience and proven methods. Whether the goal is consistency or complexity, or something bold and assertive, Canton has the products and the experience to meet the most exacting needs of today's winemaker.

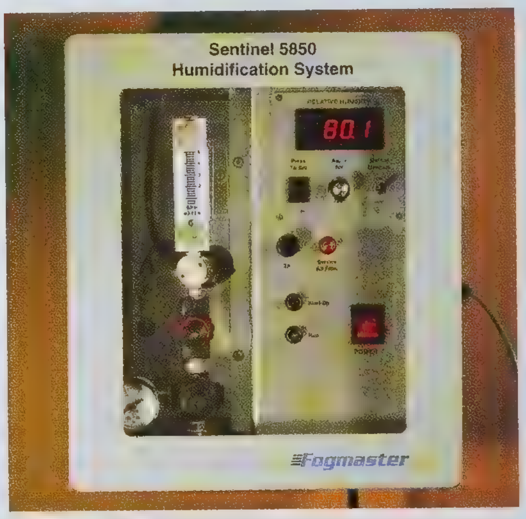
For more information, contact:

Canton Cooperage
365 S Woodlawn Ave., Lebanon, KY 40003
website: www.cantoncooperage.com
Ken Seymour, West Coast Sales
tel: 707/542-1158; fax: 707/544-7684
e-mail: kseymour01@sprynet.com
Tim Diplacido, East Coast Sales
tel: 216/531-0494
Patrick Forristal, Canadian Sales
tel: 519/885-5375

FOGMASTER CORPORATION

Fogmaster Corporation's new Sentinel 5850 fogging system helps wineries raise barrel room humidity and reduce topping losses. This low-pressure system uses turbulent air to atomize water in a fog of tiny droplets. The nozzles have no tiny orifices and are tolerant of poor water quality.

A 3.5-digit LED display continuously shows room humidity and, at the press of a button, the target humidity. A simple turn of the front panel knob changes the set point.



The system does not require a pump on the water supply. City or well water is adequate and a hose-bib connector is included. Water controls (pictured) allow droplet size to be regulated independently from humidity level, eliminating problems of fallout and wetting.

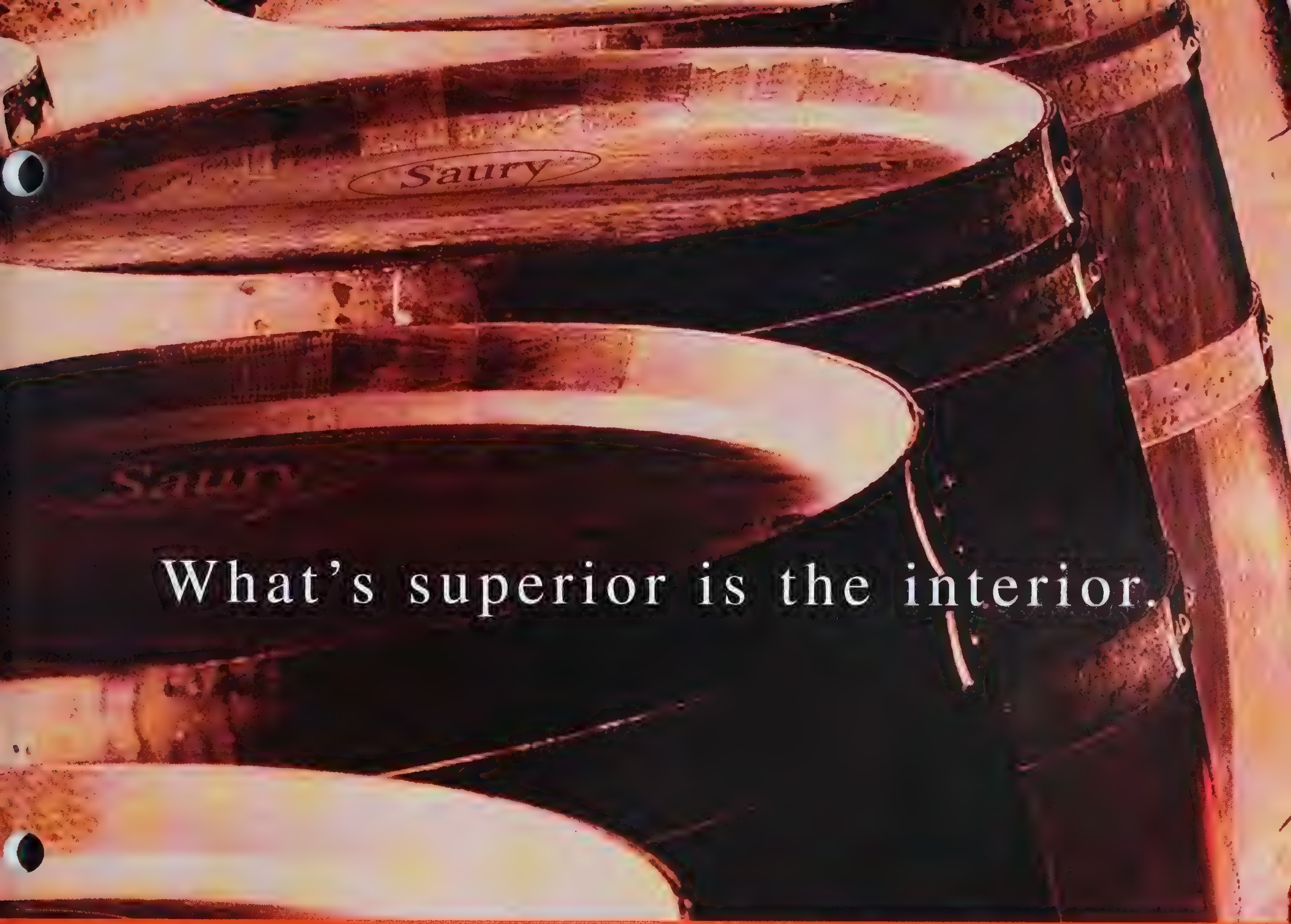
A single nozzle, positioned near the ceiling, disperses a fog plume of moist air throughout the room. A low-maintenance, regenerative blower provides atomization air to the nozzle.

The Sentinel 5850 is easy to install and well suited to the smaller winery. Typical barrel room installations are 600 to 5,000 sq. ft. in area and have ceilings from 12 to 28 ft. high.

For product specifications or more information, contact:

Fogmaster Corporation
1051 SW 30 Ave., Deerfield Beach, FL 33442
tel: 954/481-9975; fax: 954/480-8563
e-mail: info@fogmaster.com
website: www.fogmaster.com

PLEASE SEE FOGMASTER'S AD, PAGE 62.



A great wine writes a story of memory, senses, and emotions; it is alive and every story is distinctive, unique.

At Saury, our passion for great wine demands the best of our craft and ourselves: perfect grain oak, meticulous aging, and a precise toasting regime.

Let us reveal the story of Saury, where the story is written from within.

Tonnellerie
Saury®
FRANCE

Bayard FOX - TDC USA - P.O. Box 672 - Rutherford CA 94573
Tel. 707 963 3666 • Fax 707 963 8228
e-mail : Saury@juno.com

BL/LB FRANCE

BARREL BUILDERS

Barrel Builders is the exclusive distributor of Tonnellerie Marchive barrels from France, Budapesti Kadar barrels from Hungary, and Barrel Builders' barrels from EBC in Kentucky.

Located in the heart of the Cognac region, Tonnellerie Marchive was a pioneer of long, slow toasting, which produces the depth and range of flavors sought after in premium French oak barrels. Using woods sourced from leading French forests, the cooperage produces a full range of Burgundy and Bordeaux style barrels, including a 265-liter hybrid.

Budapesti Kadar barrels, imported to the U.S., are built to Barrel Builders' specifications in Burgundy, Bordeaux, and hybrid styles. Oak is sourced exclusively from the Zemplen forest above Tokaj (sustainably managed since 1789) and is similar in texture and flavor to the oaks of central France. These barrels have developed a devoted following since first introduced in 1993.

The EBC Barrel Builders American oak barrel, coopered from two- or three-year-old wood in Kentucky, compares with the finest American oak barrels and offers European quality at American prices.

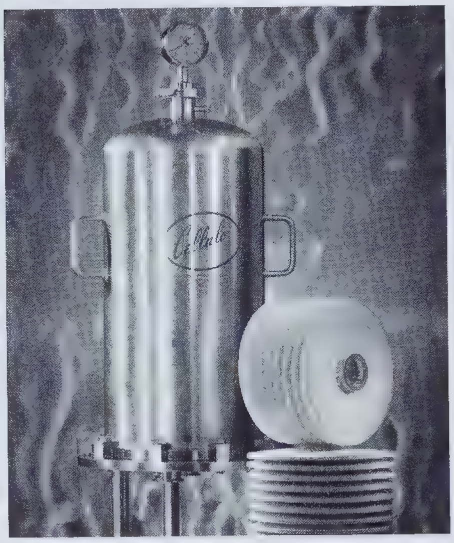
Barrell Builders is a full-service shop, offering insert systems, shaving, retoasting, and repair, as well as four styles of bungs manufactured in its plant, and Proxyclean, for cleaning everything from barrels to press bladders.

For more information, contact:
Barrel Builders, Inc.
PO Box 268, St. Helena, CA 94574
tel: 800/365-8231 or 707/942-4291
fax: 707/942-5426

PLEASE SEE BARREL BUILDERS' AD, PAGE 97.

GUSMER*CELLULO* COMPANY

Gusmer*Cellulo* Company is a manufacturer and supplier of filter media and wine processing aids. As one of the country's largest manufacturers of depth-filter media, Gusmer*Cellulo* offers a full range of filter sheets, lenticular cartridges, housings (see photo), and pre-coat filter fibers for wine filtration applications. Gusmer*Cellulo* is the exclusive distributor for Millipore filtration products, offering a wide range of filter cartridges and housings.



Recently introduced is Millipore's new Vitipore and Bevigard line of filter cartridges. Millipore took its tough PVDF membrane and designed the 0.65-µm and 0.45-µm Vitipore membrane filter cartridge to meet winemaker's specific needs. There is a full range of Bevigard clarification and pre-membrane cartridges, and the Integritest Mini IIP is for automated integrity testing.

Gusmer*Cellulo*'s Cellu-Stack lenticular depth-filter cartridges are ideal for filtration of high-quality wines. A full spectrum of grades is available to cover rough, polished, and pre-membrane filtration applications.

The Cellu-Stack sanitary filter housings offer some advantages over plate filters, including full utilization of the filter media, a reduction of wine loss due to edge leakage, and a minimized hold-up volume. The housings are manufactured from 316L stainless steel and hold one to four Cellu-Stack cartridges (18-sq. ft. to 72-sq. ft. effective filtration surface area).

For more information, contact:
Gusmer*Cellulo* Company
Don Krull, Shadow Ostowari, Phil Crantz or Ken Stewart
81 "M" St., Fresno, CA 93721
tel: 559/485-2692; fax: 559/485-4254
e-mail: sales@gusmercellulo.com
website: www.gusmercellulo.com

PLEASE SEE GUSMERCELLULO'S AD, PAGE 90.

NAPA FERMENTATION SUPPLIES

Napa Fermentation Supplies offers a full line of winemaking equipment and supplies, including LA Inox stainless steel tanks in variable capacity with adjustable lids in sizes from 26 gallons to 1,321 gallons and closed top tanks from 79 gallons to 3,963 gallons, with or without manway.

Also available from Napa Fermentation are Karcher hot water pressure washers with 1,300 psi to 3,000 psi and temperatures from 86°F to 285°F steam; one-inch and 1.5-inch Jabsco pumps with AC inverter drive; two-inch or three-inch Zambelli must pumps with AC inverter drive; Zambelli crusher/destemmers from two to 10 tons per hour; Zambelli manual and hydraulic presses; eight-inch Zambelli plate filters; a full line of stainless steel fittings and valves, butterfly and ball; one-inch to four-inch wine hose; labware; refractometers; wine thieves; and table-top labelers.

For more information, contact:
Napa Fermentation Supplies
575 Third St., Bldg. A, Napa, CA 94559
tel: 707/255-6372; fax: 707/255-6462

PLEASE SEE NAPA FERMENTATION'S AD, PAGE 83.

MENDOCINO COOPERAGE

Mendocino Cooperage combines the traditions of coopering, innovative technology, an inventive American spirit, and an internationally recognized and certified Quality Management System (ISO 9001:2000, BSI Registration #FM59862) to produce premium quality American, French, and Hungarian oak barrels. Continuous improvement is the ultimate goal and all suggestions and ideas from customers are welcome.

Raw oak material is carefully selected for Mendocino Cooperage's American, French, and Hungarian barrel programs. All oak is seasoned and aged a minimum of two years before coopering. Three different American white oak origins, representing distinct *terroirs*, are sourced and designated as Appalachian, Ozark, or Northern.

New equipment, including a TM2000 jointing machine, a laser engraver, and a barrel head/chime sander, allows Mendocino Cooperage to craft exceptionally sound and well-finished barrels with winery logos, specific harvest details, and barrel specifications.

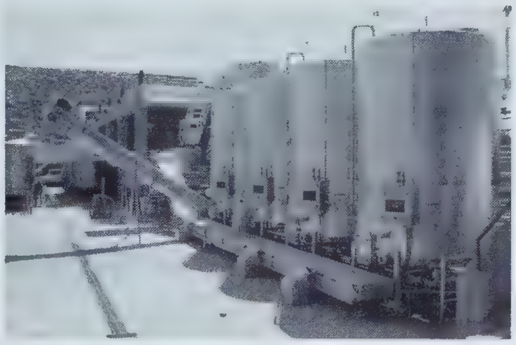
New products launched in 2001 include American oak tank inserts and exclusive global distribution of The Oak Barrel Sleeve. These products are designed to provide quality to the cost-conscious winemaker.

Carefully-monitored oak fires are timed to slowly heat the wood and achieve a deep and penetrating traditional toast for all Mendocino Cooperage barrels: 30-gallon, 225L Bordeaux, 228L Burgundy, 70-gallon (265L), and 80-gallon (300L).

For more information, contact:
Mendocino Cooperage
12901 East Side Rd., Hopland, CA 95449
Customer Service:
tel: 888/340-2244 or 707/744-7425
Raymond Willmers (Northern California)
tel: 707/939-9790
Steve Tillmann (Central Coast & Southern California)
tel: 805/462-2767
Mike Dine (Pacific Northwest & Canada)
tel: 503/784-6527

PLEASE SEE MENDOCINO COOPERAGE'S AD, PAGE 40.

PACIFIC DESIGN & MANUFACTURING, INC.



Pacific Design & Manufacturing, Inc., specializes in the design, fabrication, and installation of winery process equipment. Pacific's designers work early in the design phase with clients to produce extremely accurate drawings that reflect the process and equipment needs of the winery.

The company's founder, Steve Koster, has designed, manufactured, and installed production equipment for many wineries in Napa and Sonoma counties and the Central Coast region of California for over 25 years.

Pacific's products include: hoppers, sorting tables, belt conveyors, screw conveyors, catwalks, must lines, wine lines, and fermentation tanks.

Whether you need new construction or a modernized project, Pacific will help formulate a master plan and design that allows for efficient operation, while remaining flexible to changes in the industry.

Pacific has introduced an Automatic Red Wine Fermenter. The system uses advanced fluid technology to achieve the extraction desired without the extreme maceration found with mechanical systems. Installations of these fermenters have had great results.

Pacific's Red Wine Fermenter features computer-controlled cap management from beginning to end. Functions performed include pump-overs, cap irrigation, cap mixing, and self-emptying. The fermenters can also be used for storage.

For more information, contact:
Pacific Design & Manufacturing, Inc.
30 Mill St., Bldg. D, Healdsburg, CA 95448
tel: 707/431-3516; fax: 707/431-3519

PLEASE SEE PACIFIC DESIGN & MFG.'S AD, PAGE 56.

RLS EQUIPMENT COMPANY, INC.

RLS Equipment Company, Inc., has provided the wine industry with quality equipment and service for more than 40 years and is the authorized agent for Kiesel, Magitec, Pera, and Strassburger. RLS can supply your winery with a complete crushing and pressing facility.

Magitec stemmer/crushers are available in capacities from the new ***ultra-low*** 2.5 tons per hour (tph) capacity to more than 75+tph with efficient design, durable construction, gentle action, and affordable prices.

Pera membrane presses are available from 30hl to the new 480hl capacities with either an open-slotted or enclosed-drum configuration. Pera offers the H-Series stemmer/crusher from 4tph to more than 100+tph capacities.

Kiesel progressive-cavity pumps are available in both hopper and in-line styles from 1,000 liters per hour to more than 200+tph. Kiesel offers a complete line of portable heating/chilling units along with unique "corrugated" tube-in-tube heat exchangers available in sizes for hundreds of gallons to thousands of gallons.

Strassburger offers high-quality plate/frame, and lees filters. Stainless steel construction with either S/S or noryl plates are durable and easy to clean. A wide variety of filter pads are available.

RLS offers domestically produced, replacement membranes for most presses and an extensive inventory of used equipment.

For more information, contact:
RLS Equipment Co., Inc.
1017 White Horse Pike
Egg Harbor, NJ 08215
tel: 609/965-0074 or
West Coast tel: 800/527-0197
fax: 609/965-2509
e-mail: rls.equip@worldnet.att.net

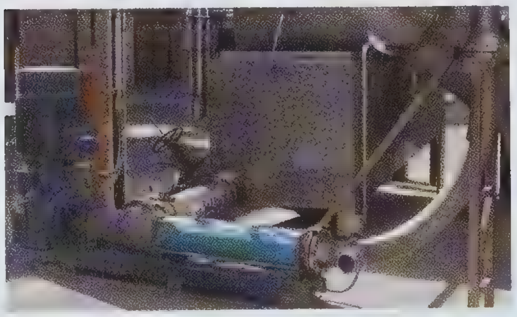
PLEASE SEE RLS EQUIPMENT'S AD, PAGE 39.

R.F. MacDonald Company

"We service what we sell" has been R.F. MacDonald's motto since its founding in 1956.

R.F. MacDonald is a pump supplier that specializes in custom winery applications. The company represents various pump manufacturers such as Seepex, Warren Rupp, Goulds, Vertiflo, and Alfa Laval G&H. Sales and service offices are located in Hayward, Modesto, and Fresno, CA. Service technicians are available for field visits after the equipment is shipped, ensuring the pumping equipment is operating as promised.

Seepex manufactures a low-shear, positive-displacement pump. Often mounted on a portable, stainless steel cart with an AC-frequency inverter and dry run protection, this versatile pump is used for a wide range of winery services including must pumping, whole-berry transfer to press, lees and pomace transfer, juice pump-overs, and finished wine bottling.



Seepex must pump

Warren Rupp's flapper-valve, air-operated diaphragm pump is available for stationary and portable applications, including juice transfer, pump-overs, and lees transfer. The flapper valve allows inlet- and outlet-sized solids (up to two inches) to pass through the pump without hang-up.

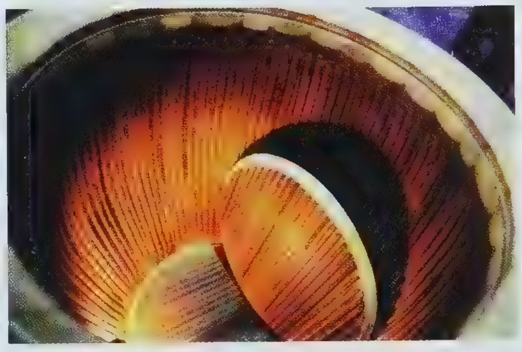
Goulds, Vertiflow, and Alfa Laval offer centrifugal pumps with open and vortex-style impellers for many winery applications.

Please contact R.F. MacDonald for an analysis of your equipment needs by one of its technical consultants.

R.F. MacDonald Company
25920 Eden Landing Rd.
Hayward, CA 94545-3816
tel: 510/784-0110; fax: 510/784-1004
e-mail: info@rfmacdonald.com
website: www.rfmacdonald.com

PLEASE SEE R.F. MACDONALD'S AD, PAGE 64.

Seguin Moreau



The taste of an exquisite wine is the result of a marriage of flavors from the grapes themselves and the barrels that hold the wine during the ageing process. Seguin Moreau's commitment to quality and consistency is a benchmark for the wine industry. This may explain why Seguin Moreau barrels are in winery cellars throughout the world. It is Seguin Moreau's dedication to innovation and research that has resulted in a vast product line in American, French, Russian, and European oaks.

Seguin Moreau is the only French cooper that buys 100% *haute futaie* for its French oak barrels. Its U-stave barrel continues to grow in popularity and is unique only to Seguin Moreau. Available in American oak, this barrel provides a greater depth of toast. It enhances the wine with depth and elegance, providing a sweet, rich palate.

Seguin Moreau's Russian oak and European blends were developed to add the same characteristics as French oak, offering clients another source of *Quercus Sessilis*, thus meeting the growing demand for quality oak. Seguin Moreau offers a barrel for every winemaking program.

Seguin Moreau blends prestigious French tradition, American resources, and dedication to its clients to help you make the best wines possible.

For more information, contact:
Seguin Moreau Napa Cooperage
151 Camino Dorado, Napa CA 94558
tel: 707/252-3408; fax: 707/252-0319
e-mail: john_schilter@seguinmoreau.com
john_forster@seguinmoreau.com
website: www.seguinmoreau.com

PLEASE SEE SEGUIN MOREAU'S AD, PAGE 33.

Saeplast

Saeplast manufactures a wide range of insulated containers and pallets to meet the wine industry's strength, hygienic, environmental, and user-friendly requirements.

Saeplast's insulated containers are the result of more than three decades of innovative research and development. All containers are constructed of FDA-, Agriculture Canada-, and USDA-approved materials for food application. These food-approved materials prevent the transfer of odor or taste, and the containers' insulating properties aid the fermentation process and protect perishables during transport and harvest.

Design features include: smooth interior walls for quick and easy clean up, a well-fitting latch-down lid with optional seal, an optional 3-inch drain opening (available in selected models), a reinforced base with center beam allowing versatility in handling, and a day-marker insert for content identification.

Contact Saeplast for further information regarding these or other products and to find the distributor closest to your area.

Trust Saeplast to deliver the plastic solutions you need to get the job done.

For more information, contact:
Saeplast
100 Industrial Dr.,
Saint John, New Brunswick E2L 3T5 Canada
or 7898 82nd St.,
Delta, British Columbia V4G 1L6 Canada
tel: 800/567-3966, **New Brunswick**
tel: 800/665-3966, **British Columbia**
e-mail: saeplast@saeplastcanada.com
website: www.saeplastcanada.com

PLEASE SEE SAEPLAST'S AD, PAGE 54.

RIEGER

Euro-Machines is offering custom-made quality stainless steel tanks by Rieger of Germany. Standard fermentation tanks, available both round or square, with custom jacketing, variable capacity tanks, VinoStat dejuicing tanks as well as punch-down and VinoTop fermenters for red wine are available.

Europress

Gentle handling for quality juice
Easy to fill, empty and clean
Dependable; low maintenance
Open and closed style membrane presses
Sizes available: 1,200 to 32,000 liters

BRAUD

- Braud Saphir Series SB is a year-round multi-function, self-propelled harvester and utilizes the most advanced harvesting technology available!
- Braud 2720 is a self-propelled harvester which is also multi-function and can be used year round. Spraying, hedging, cultivating, planting and harvesting all in one machine!
- Braud 524RH is a tractor pulled model which is efficient and affordable for any vineyard!

For more information call or write:

Euro Machines, Inc.
vineyard and winery equipment company

East: P.O. Box 843 • Culpeper, VA 22701 • Tel: (540) 825-5700 • Fax: (540) 825-5789
West: 4950 Fulton, #E • Suisun City, CA 94585 • Tel: (707) 864-5800 • Fax: (707) 864-5879
www.euromachinesusa.com

MOON VALLEY CIRCUITS

Moon Valley Circuits has been building winemaking electronics since 1979, specializing in tank-temperature, barrel-room, and refrigeration control systems of unfailing reliability. Used in many premier wine industry facilities, Moon Valley Circuits' systems feature precise, reliable control, recording, and supervision.

Moon Valley Circuits has pioneered the use of proportional control for precise tank temperatures and faster, more accurate and efficient cold stabilization. The cooling supply to each tank is supervised to give early warning of a problem before the tank is affected.

MOON VALLEY CIRCUITS

The barrel-room systems offer control of refrigeration, night-air, humidity, CO_2 and ozone ventilation, with graphic-feedback display. Refrigeration equipment can have every detail instrumented, controlled, displayed, and recorded.

An intuitive, graphic-PC interface makes Moon Valley Circuits' systems easy to learn and use, and accessible anywhere by network or modem. Long- and short-term automatic recording provide a history of critical information for troubleshooting and quality research. Alarms are prioritized for ease of use.

Moon Valley Circuits' systems are built expressly for wineries, designed to cope with wet conditions and power outages, and to be used and maintained by winery personnel. In the middle of crush, when all else is chaos, this system works.

For more information, contact:
Moon Valley Circuits
12350 Maple Glen Rd., Glen Ellen, CA 95442
tel: 707/996-4157
e-mail: moon_valley@vom.com

PLEASE SEE MOON VALLEY CIRCUITS' AD, PAGE 12.

TONNELLERIE SIRUGUE

Tonnellerie Sirugue is a family cooperage established in the early 1900s in Nuits Saint Georges, Burgundy. Sirugue's barrels were among the first French oak barrels to be imported to the U.S for fine wine ageing in the late 1950s and 1960s.

Today, Sirugue focuses on its wood selection, which is the basis of the cooperage's tasty barrels. Sirugue's wood is selected exclusively from French oak forests in the Allier, Nevers, Chatillon, and Vosges regions, and its staves are naturally air-dried in Burgundy for a minimum of 24 months. A 36-month, air-dried program is available by reservation.

Sirugue produces Burgundy Traditional and Export barrels (228L) and Bordeaux Export barrels (225L).

Sirugue has worked intensively to achieve different toasting levels tailored to each customer's individual needs and stylistic demands and also continues to offer its traditional house toast.

Sirugue's goal is a seamless integration of fruit and oak. Its barrels can be sweet, spicy, subtle, and elegant; they lift your fruit, frame it, and make a star out of it.

For more information, contact:
Tonnellerie Sirugue
Francoise Gouges-Guberman
2343 33rd St., Santa Monica, CA 90405
tel: 310/452-8147; cell: 310/403-8398
fax: 310/452-7847
e-mail: siruguesa@earthlink.net

VALLEY PIPE & SUPPLY, INC.

Valley Pipe & Supply, Inc., currently in its 63rd year in business, has headquarters in Fresno, CA, a branch office in Napa, CA, and a sales office in Sonora, Mexico. Valley Pipe & Supply was founded in 1940 as a supplier to many food processing, chemical, industrial, and OEM manufacturing plants in the surrounding San Joaquin Valley and began importing and manufacturing equipment for the wine and beverage industries throughout the U.S. and Mexico in the late 1980s.

To be of more service to its customers, Valley Pipe & Supply has a full-time technician trained at several of the overseas factories whose machinery Valley Pipe & Supply represents.

The Valley Pipe & Supply showroom in Napa displays membrane presses, automatic punchdown tanks, the "Puntarossa" automatic punchdown and pumpover combination tank (manufactured by Defranceschi S.p.A.), Milani Antares destemmers, Spadoni filters, Enopompe piston pumps, and other winery pumps and industrial supplies.

Banding of the new Valley Pipe & Supply "Cuvee" rubber hose and several styles of PVC hose is done at the Fresno and Napa locations. Fabrication of all stainless hoppers, dumps, conveyors, three-way must valves, Valley Pipe & Supply pumps, and PCT fittings is done at the Fresno location.

Valley Pipe & Supply would like to thank the wine industry for your patronage and support and looks forward to being of service to you in the future.

For more information, contact:
Valley Pipe & Supply, Inc.
1801 Santa Clara, Fresno, CA 93721
tel: 559/233-0321; fax: 559/233-1713
Napa Showroom
4405 Solano Ave., Napa, CA 94558
tel: 707/226-6427; fax: 707/226-7593

PLEASE SEE VALLEY PIPE & SUPPLY'S AD, PAGE 55.

Tonnellerie Boutes

Tonnellerie Boutes (Boutes) has produced barrels in a family tradition, for over 120 years. Family-owned and operated by Henri Barthe and his two sons, Eric and Pierre, Boutes is located in the heart of the Bordeaux region of France.

Boutes guarantees its wood source by being one of the largest purchasers of standing oak trees at the National Forestry Department auctions in Allier. The forests of the Allier region consistently yield the tightest grain woods in all of Europe.

BOUTES
TONNELLERIE DE FRANCE

New for 2002 is an innovative Grand Reserve barrel offering a special blend of hand-selected staves of the finest wood from Boutes' own *merrandier*. Along with a special toasting method, this barrel offers your wine richness, length, and volume without harshness. Offered in limited quantities, this truly is a special barrel.

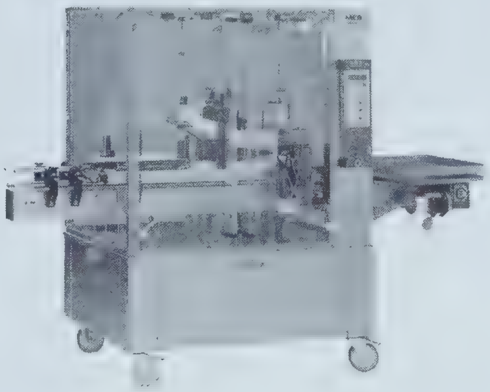
Unique to Boutes is the stave-immersion process that prepares and controls refinement of oak tannins. This, along with exclusive use of the finest oak woods and knowledge of its master coopers, allows Boutes to offer a unique blend of innovation, tradition, and art in crafting barrels that achieve perfect harmony between wine and barrel.

Barrel sizes available are: 225L, 228L, 265L, 300L, and 500L.

For more information, contact:
Tonnellerie Boutes
Manny Martinez
1001 Seascape Circle, Rodeo, CA 94572
tel: 510/799-1518; fax: 510/799-1557
e-mail: boutesusa@aol.com

PLEASE SEE TONNELLERIE BOUTES' AD, PAGE 14.

Criveller Company



Criveller Company, supplier to the wine and beverage industry, reports that its office in Santa Rosa, CA, has been in operation for over two years. Criveller California Corporation hopes to better serve wineries in California, Oregon, Washington, and surrounding western states.

Criveller carries a wide variety of processing equipment for every winemaking phase and fabricates stainless steel tanks according to your specifications.

In conjunction with leading manufacturers of bottling and labeling equipment, Criveller offers manual, semi-automatic, or fully automatic-bottling lines, including cost-effective monoblocs and triblocs that cater to all your bottling needs.

Criveller's warehouses in Niagara Falls, Canada, and Santa Rosa, CA, have various models of bottling equipment, filtering equipment, destemmer crushers, presses, and stainless steel tanks, including variable capacity and stock mini-tanks, available for viewing.

For more information, contact:
Criveller Company
West Coast: Criveller California Corp.
Scott Beattie or Rose Marie Galante
1540-A Petaluma Hill Rd.
Santa Rosa, CA 95404
tel: 707/526-2930; fax: 707/526-2931
e-mail: crivca@sonic.net
Canada:
Bruno or Mario Criveller
6935 Oakwood Dr.
Niagara Falls, Ontario L2E 6S5
tel: 905/357-2930; fax: 905/374-2930
e-mail: cri@criveller.com
East Coast:
P.M.B. 202, 1623 Military Rd.
Niagara Falls, NY 14304-1745
tel: 905/358-5202

PLEASE SEE CRIVELLER'S AD, PAGE 78.

Lloyd W. Aubry Co., Inc.

The Lloyd W. Aubry Co., incorporated in 1962, has specialized in design, fabrication, installation, and modification of equipment, machinery, material-handling systems, and related structural and piping work for the beverage industry for 40 years.

Successful completion of over 9,600 projects has provided knowledge, expertise, and experience invaluable to the necessary partnering with customers regardless of work scope and schedule requirements. Lloyd Aubry Co.'s field and management personnel take pride in their problem-solving abilities, quality of work, character, and aptitude for providing a safe, accident-free workplace.

In the last several years, Lloyd Aubry Co. has performed for more than 250,000 manhours and maintained an exceptional safety record. During this time period, its workers' compensation experience modification factor has averaged between 0.60 and 0.82.

Lloyd Aubry Co. can provide maintenance personnel as needed to undertake the complete design/build for grape handling and bottling lines. The company works with both large and small clients to produce results that reflect excitement, energy, and expertise.

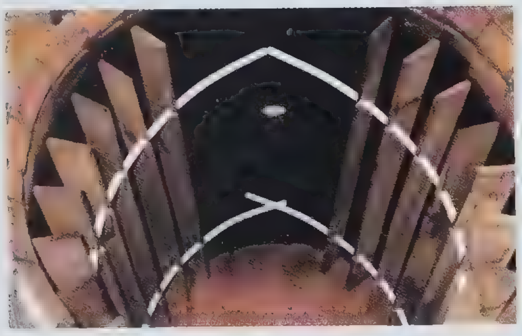
With annual sales of $20 to $25 million, the Lloyd Aubry Co. is large enough to handle the most demanding projects and schedule requirements yet small enough to offer each customer the personal attention necessary to insure a successful result.

Lloyd Aubry Co. maintains a full-line fabrication shop in Hayward, CA, and satellite operations in White City, OR, and Little Rock, AR.

For more information, contact:
Lloyd W. Aubry Co., Inc.
2148 Dunn Rd., Hayward, CA 94545
tel: 510/732-9038; fax: 510/732-3137
e-mail: robert@lloydaubry.com

PLEASE SEE LLOYD AUBRY CO.'S AD, PAGE 34.

INNERSTAVE, INC.



"Original ideas are few," and most are not effective tools to save time or money. Innerstave is the original barrel insert and has been used as an effective tool to add oak character to wines for over 20 years. It saves money through lower costs for oak barrel flavors.

Since 1979, Innerstave has gained wide acceptance in all forms of barrels and tanks because of its exclusive, non-invasive, cleanable design. Innerstave, designed for stainless tanks, requires no welding and is installed by the company's own qualified coopers.

Innerstave receives highest acclaim for its award-winning, premium oak character that can be found in many highly rated wines. An onsite supply of aged French and American oak ensures availability of prepared oak for each order, and gives the winemaker control of oak type, wood-to-wine ratio, and toast level. Each is important when making award-winning wine.

Innerstave works closely with winemakers, so the decisions of wood type and toast level match each wine. Innerstave design, manufacturing, and installation staff then carefully adheres to these decisions. All wineries purchasing from Innerstave are guaranteed satisfaction.

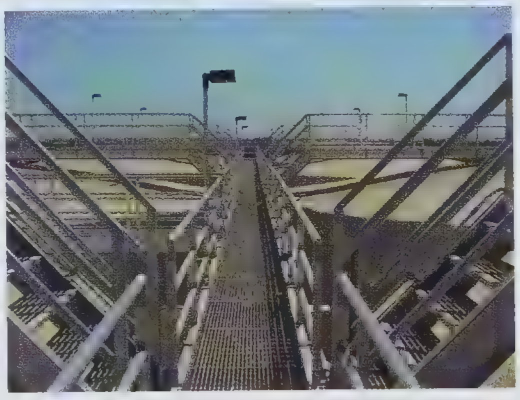
For more information, contact:
Innerstave, Inc.
Bob Rogers
24200 Arnold Dr., Sonoma, CA 95476
tel: 707/996-8781; fax: 707/996-1157
e-mail: bob@innerstave.com

PLEASE SEE INNERSTAVE'S AD, PAGE 17.

OGLETREE'S

For over 50 years, Ogletree's has specialized in the customized fabrication of winemaking equipment for California's wineries and vineyards. These vintners rely on Ogletree's to care for the nuance and detail of their receiving hoppers, belt and screw conveyors, transfer lines, catwalk systems, and other structural components.

Ogletree's eye for detail focuses on the refinements of clean, finished work, polished welds, and well-fitting assemblies.



Because of Ogletree's more than 100 years of collective experience in the wine industry, winemakers and winery owners get more than just an aluminum catwalk system or stainless steel processing equipment when they contract with Ogletree's to work with them; they get a storehouse of knowledge that no one person alone could offer.

Ogletree's working knowledge of the industry enables company designers to see potential problems or flaws in design or planning of expansions and upgrades. This familiarity allows Ogletree's to offer solutions and new designs to achieve the original, intended goal.

Ogletree's has proven to be a valuable partner to all its clients. Serving the industry from its facility in St. Helena since 1946, Ogletree's helps wineries, large and small, distinguish their products in a competitive marketplace.

For more information, contact:
Ogletree's
935 Vintage Ave., St. Helena, CA 94574
tel: 707/963-3537; fax: 707/963-8217

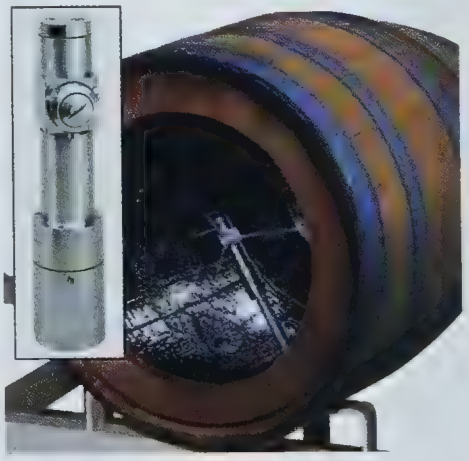
PLEASE SEE OGLETREE'S AD, PAGE 77.

GAMAJET CLEANING SYSTEMS, INC.

Gamajet designs, manufactures, sells, and services an ever-growing line of tank cleaning machines and equipment to remove a variety of residues from the interiors of vessels. Each Gamajet system utilizes impingement cleaning to efficiently and rapidly scour every square inch of the tank interior.

All Gamajet products are field-serviceable, rugged, durable, and versatile. Gamajet's service capability is provided by strong technical support and extensive applications know-how. Gamajet fills orders and repairs units promptly and continually analyzes components and designs in order to provide new and better products.

The Gamajet Barrel Blaster is a small, powerful unit ideal for cleaning all types of barrels and drums. It eliminates extensive handling and potential damage to barrels by offering one-step, one-insertion cleaning. The Barrel Blaster can deliver "as new" cleaning in less than two minutes and works especially well in tough wine-cleaning situations.



The combination of rugged, long-lasting design, powerful jet spray cleaning, and field serviceability has long made Gamajet a strong choice among the world's best-known manufacturers. The Barrel Blaster represents a major technological breakthrough, offering some of the most powerful cleaning available in a compact, easy to handle size.

For more information, contact:
Gamajet Cleaning Systems, Inc.
PO Box 626, Devault, PA 19432
tel: 610/408-9940; fax: 610/408-9945
e-mail: sales@gamajet.com
website: www.gamajet.com

PLEASE SEE GAMAJET'S AD, PAGE 11.

Belt Receiving Hopper, the latest concept in product handling, fabricated and installed by Ogletree's at Gallo of Sonoma.

Aluminum Catwalks and Pipe Supports fabricated and installed by Ogletree's at Sutter Home, Main Street.

Radial Arm Belt Conveyor (without belt) fabricated and installed by Ogletree's at Gallo of Sonoma.

OGLETREE'S

Building for the future.

When the technological leaders of the wine industry need an innovative metal fabricator, they call on Ogletree's.

Since 1946, from the heart of California's premier wine producing region, we have built our reputation on quality wine making equipment that has kept progressive wineries on the cutting edge.

Ogletree's specializes in designing, fabricating and installing a wide variety of winery equipment including:

- **Receiving Hoppers**
- **Aluminum Catwalks**
- **Stainless Steel Juice Tubs**
- **Variable Speed Belt and Screw Conveyors**
- **Stainless Juice and Must Lines**

We also provide assembly and installation services for:

- **Grape Presses**
- **Rotary Fermentors**
- **Filter Systems**
- **Heat Exchangers**

Facility upgrades and expansions take time and planning. Call us now to reserve our time, knowledge and expertise to help you plan an increase in efficiency, productivity and your future as an industry leader.

OGLETREE'S

935 Vintage Avenue
St. Helena, CA 94574
Ph [707] 963-3537
Fx [707] 963-8217
CA Lic. Contractors #340151

PICKERING WINERY SUPPLY

Pickering Winery Supply offers stainless steel tanks from Modern Stainless & Design and French, Eastern European, and American oak barrels from three coopers.

Modern Stainless & Design manufactures some of the finest tanks on the market that have high-grade finishes and zone-four-spec standards on its tank stands. Modern Stainless & Design's new plant uses the latest technology to increase production and has become one of the largest tank producers to the California wine industry. Additionally, Modern Stainless & Design now has its own trucks and cranes to offer greater value to the customer.

Tonnellerie Vernou success was earned by superbly crafting barrels it controlled from the "grumes" to the finished barrel. The production goal is to provide a consistent barrel every year. In addition to familiar forest offerings, customers can specify Pinot Noir or Chardonnay barrels with longer toasts; "waterbent" for Sauvignon Blanc; 24-month air-dried American oak; or the hybrid, AOFO barrel that accentuates the best of American staves and French toasted heads.

Tonnellerie Meyrieux toasts its barrels over small braziers for 1½ hours to achieve a smoky, fruit-driven barrel ideal for Burgundy varietals and Syrah. Production is limited from this tiny Burgundian cooper.

Tonnellerie Doreau's barrels originate only from the tightest-grained wood (<2mm). Its initial success has been with long-aging Bordeaux reds. However, the barrels' elegance and slow extractability have proven ideal for Chardonnays, Italian reds, or any wines that seek an oak backbone to high-quality fruit.

For more information, contact:
Pickering Winery Supply
888 Post St., San Francisco, CA 94109
tel: 415/474-1588; fax: 415/474-1617
e-mail: jpick@dnai.com

PLEASE SEE PICKERING'S ADS, PAGES 62, 94.

ELECTRO-STEAM GENERATOR CORP.

Electro-Steam Generator Corp. is one of the original U.S. manufacturers of generators and cleaners powered solely by electricity and steam, and is in its 49th year of operation.

Electro-Steam manufactures generators and cleaners that operate at 98% efficiency and are safe to operate, which results in lower insurance cost than fossil fuel units. Each quality generator utilizes the finest components on the market and is hand-built to suit specific applications that, with care, will provide years of efficient, dependable service.

Live steam can be used for sterilizing bottling lines, melting tartrates, rejuvenating barrels, cleaning equipment, and various other uses.

No pretreatment water chemicals are required. Portable and stationary (point-of-use placement) units are available.

For steam cleaning, each generator comes with a steam gun, a 10-foot dual (steam and detergent) hose, a detergent tank, and gloves.

All Electro-Steam equipment is built in accordance with the highest possible approvals including: ASME Miniture Code, National Board of PVI Shop Inspection, UL, ETL, CSA, and meet OSHA requirements. CE certification is offered as an option.

For more information, contact:
Electro-Steam Generator Corp.
1000 Bernard St., Alexandria, VA 22314-1299
tel: 800/634-8177; fax: 888/783-2624
e-mail: sales@electrosteam.com
website: www.electrosteam.com

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Santa Rosa, CA 95404
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Fax: (707) 526-2931

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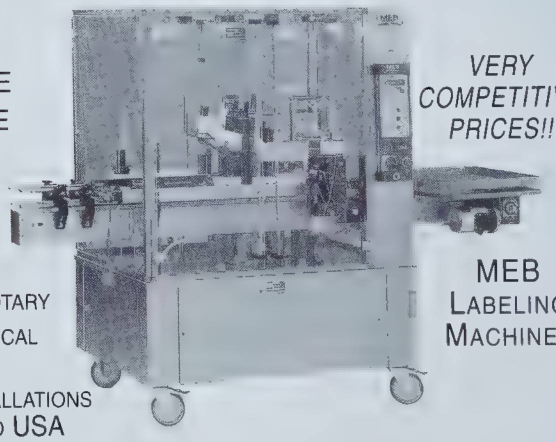
6935 Oakwood Drive
Niagara Falls, ON L2E 685
Ph: (905) 357-2930
Fax: (905) 374-2930

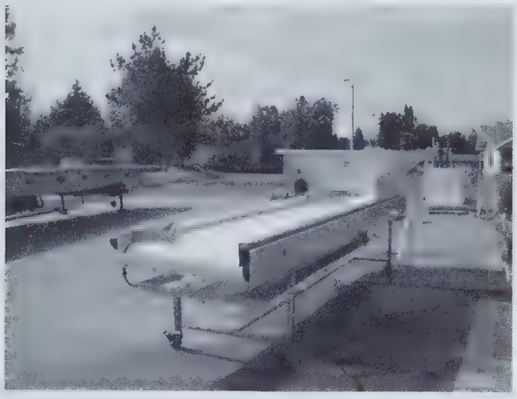
East Coast U.S.A.:
P.O. Box 162
Lewiston, NY 14092
Ph: (905) 358-5202

Email: cri@criveller.com
Web Site: www.criveller.com



P&L SPECIALTIES

P&L Specialties is a custom manufacturer of innovative stainless steel winery equipment and provides crush pad design and engineering, equipment installation, machine shop services, field service, and maintenance programs.



P&L Specialties' product line includes: sorting tables, belt conveyors, receiving hoppers, screw conveyors, 1/2-ton bin dumpers, pump-over carts, catwalks, destemmer stands, press feed hoppers, vibratory tables, overhead trolley hoists, rotary screens, fitting boards, hose racks, the "Brix Buddy," cellar equipment, and many other custom-fabricated items.

Eighteen years of winery equipment-manufacturing experience is demonstrated in P&L Specialties' ability to combine attractive design with rugged durability. Its design team values two-way communication in providing cost-effective solutions to meet unique requirements. P&L Specialties stands behind its products and is dedicated to long-term relationships with customers.

From small, fabricated, single pieces to completely installed fruit-processing systems, P&L Specialties consistently can deliver high value and quality and appreciates the opportunity to demonstrate its commitment to producing quality equipment, satisfying customer expectations, and delivering on-time performance.

For more information, contact:
P&L Specialties
1450 Industrial Ave., Sebastopol, CA 95472
tel: 707/829-4811; fax: 707/823-2994

CARLSEN & ASSOCIATES

Carlsen & Associates designs, manufactures, and represents equipment for many aspects of the wine industry including:

- Receiving hoppers,
- Puleo stemmer/crushers,
- Waukesha must pump systems,
- Puleo open-screen membrane presses and closed tank presses,
- Waukesha centrifugal pumps,
- Yamada air pumps,
- Pump-over sumps,
- Pump-over devices,
- Ozone sanitation systems,
- Valves and fittings.

Carlsen & Associates produces quality products and services that provide simple solutions to your needs.

For more information, contact:
Carlsen & Associates
1439 Grove St., Healdsburg, CA 95448
tel: 707/431-2000; fax: 707/431-2005

PLEASE SEE CARLSEN & ASSOCIATES' AD, PAGE 19.

WESTEC TANK COMPANY

Westec Tank Company (WTC), a division of the Alary Corporation, is continuing to improve and innovate the wine tank manufacturing process. Its state-of-the-art approach to tank manufacturing, along with its experienced and well-trained personnel, permits the production of top quality stainless steel wine tanks.

WTC can build wine tanks from 100- to 50,000-gallon capacity in its shop, and has field tank erection and fabrication capabilities to fulfill all capacity requirements. WTC has added a new tank shop in Paso Robles, CA. Mike Power is the contact and can be reached at 805/227-1641.

Westec manufactures rotary fermentors of 28T, 50T, and 100T capacity, which were developed and licensed by A&G in Australia for distribution by Conetech.

Westec Equipment has expanded its line of winery accessories to include: sump carts, SO_2 dosers, glycol heaters, W.E. Ware lines, tank parts, valves, pump over irrigators, cooling panels, barrel turners, and more. Contact Jim Kime at 707/431-9342 for information about the newly added line of W.E. Ware & Co. winery accessories.

The Westec equipment division now manufactures barrel racks at its shop in Stockton, CA; contact Bill Booth at 707/431-9342.

For more information, contact:
Alary Corporation
PO Box 129, Healdsburg, CA 95448
tel: 707/431-9342; fax: 707/431-8809

PLEASE SEE WESTEC'S AD, PAGE 63.

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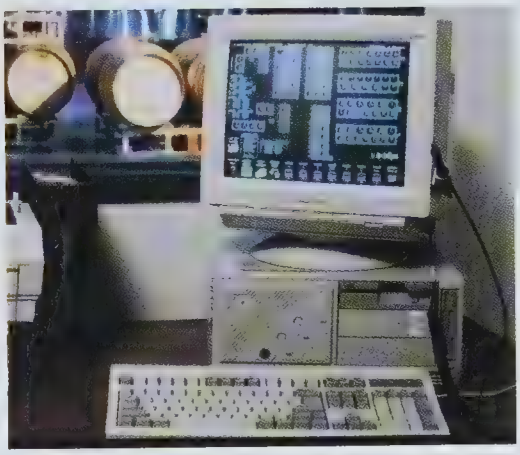
LOGIX



Wineries choose the Logix Winery Control System for two reasons: exceptional results and unsurpassed service. For everything from controlling tank temperatures to cutting energy costs to planning equipment maintenance, the Logix system is user-friendly and super-effective. With the system's programmable technology, you get a high level of flexibility and control and end up with more time to focus on the art of your craft.

By precisely controlling fermentation temperatures and integrating a variety of related processes, Logix ensures the wine you want is the wine you get. Plus you'll be ready for success in the long haul by operating more efficiently than your competitors.

With a Logix system, winemakers can plan and implement the ideal fermentation process, generate a wealth of information about their winemaking, and improve overall facility operations. Besides making fermentation easier and more precise, Logix systems ensure energy-efficient refrigeration equipment operation, maintain accurate barrel room control, and monitor CO_2 and other gases.

The system features 24-hour remote alarm notification and access capabilities that give you peace of mind. With a Logix system, you partner with an experienced team of controls professionals who'll keep your winery at peak performance every day.

For more information, contact:
Logix
10518 N.E. 68th St., Kirkland, WA 98033
tel: 425/828-4149; fax: 425/828-9682

PLEASE SEE LOGIX'S AD, PAGE 94.

T.W. BOSWELL

"A whole new world of barrels awaits your discovery."

Built by master French cooper, Cyrille Royer, the T.W. Boswell Appellation Series are French oak barrels crafted in the same fashion as those barrels found in the renowned *chais* and cellars of Médoc and Côte d'Or. The Médoc and Côte d'Or barrels are two very different French oak barrels, each complementing the distinctive wine styles of those regions. The Côte d'Or is made for Burgundian-style Chardonnays and Pinot Noirs while the Médoc is made for more concentrated wines with hints of tannin.

Master French cooper Cyrille Royer crafts T.W. Boswell barrels.

Honoring the man who founded the company in 1912, the T.W. Boswell Legacy barrel is stylish and is built to impart a subtle Old-World nuance to wine. Available in French, American, and Eastern European oak, it celebrates the passion of the wine industry and builds on a tradition of excellence.

For more information, contact:
T.W. Boswell
Ed Larmie, Yuri DeLeon, Jerry DeLorenzo, or Gary Kroll
2557 Napa Valley Corporate Dr., Ste. D
Napa, CA 94558
tel: 707-255-5900; fax: 707-255-5952
e-mail: info@twboswell.com
website: www.twboswell.com

PLEASE SEE TW BOSWELL'S ADS, PAGE 91.

StaVin Incorporated

StaVin designs versatile and cost-effective oak integration systems. Its French, Hungarian, and American oak is seasoned for three years and available in three toast levels. To ensure thorough heat penetration and complex flavors, all oak is traditionally fire-toasted.

To replicate benefits of winemaking in barrels, StaVin introduces a four-tank, micro-oxygenation system (oxBox). The system, used with StaVin's oak, allows winemakers to achieve barrel-quality flavors within tanks.

Packaged in food-grade, FDA-approved nylon bags (10-lb and 20-lb sizes), StaVin's 36-month seasoned French, Hungarian, and American Oak Beans are convenient systems for imparting oak flavors within tanks. The French Oak Stave Segment, available in 15-lb nylon bags, offers the convenience of Oak Beans with slower extraction time. During red wine fermentation, beans and segments effectively cross-link grape tannins to build mid-palate structure and stabilize color.

Modular Tank Systems or Tank Matrix filled with StaVin's 44-sq.ft. Oak Stave Packets deliver quality oak at less cost than new barrels.

StaVin's Barrel Oak Replica, traditional Barrel Insert, and Infusion Tube are methods for imparting neutral barrels with matching quality and range of flavors of new oak barrels.

StaVin is the U.S. marketing agent for Tonnellerie Berthomieu and Bernard's French oak barrels and Kelvin American oak barrels.

For more information, contact:
StaVin Incorporated
Alan Sullivan, Steve Sullivan,
Jamie Zank, Dr. Jeff McCord
PO Box 1693, Sausalito, CA 94966-1693
tel: 415/331-7849; fax: 415/331-0516
e-mail: info@stavin.com
website: www.stavin.com

PLEASE SEE STAVIN'S AD, PAGE 31.

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The AATAC staff always makes the effort to provide customers with service that is second to none. Whether you are in need of design and fabrication services or require repairs to existing systems, AATAC is a quality source for your business.

For more information, contact:
AATAC
PO Box 728, Windsor, CA 95492
tel: 707/838-3117; fax: 707/838-3009
website: www.aatac-fab.com

PLEASE SEE AATAC'S AD, PAGE 51.

KNOX INDUSTRIES

Mel Knox represents some of the best cooperages in the world.

Tonnellerie Taransaud of Merpins, France, supplies many kinds of barrels to the greatest wine estates in the world. The Taransaud secret is twofold: excellent stock of naturally air-dried wood, all age-certified by Bureau Veritas, and great attention to detail. One such detail, for example, is that a thermocouple measures the temperature of the barrels as they are toasted. Time and temperature are closely monitored so that there are no surprises.

Besides making 225-liter barrels, Taransaud also offers 350-liter, 400-liter, and 500-liter barrels. Tanks, round casks, and ovals are also produced.

In 2000, Taransaud installed 56 oak tanks at Robert Mondavi Winery, along with eight special tanks at Harlan Estate, both in Napa Valley. These tanks have a stainless steel top with a removable inner cap and are ideal for fermentation and/or storage.

Tonnellerie Francois Frères is respected for its work with the top domaines of Burgundy, California, and the world. Both Burgundy and Bordeaux-shaped barrels are available.

Francois Frères also operates a stave mill in Oregon, where staves from Oregon white oak, *quercus garryana*, are produced. Barrels are made from 18-month, 24-month, and 36-month air-dried oak.

The Francois Freres group acquired 50% interest in Trust International, based in Hungary. As the species of oak found in Hungary are the same as those found in France, barrels that result from this alliance should interest winemakers.

For more information, contact:
Mel Knox, Knox Industries
505 29th Ave., San Francisco, CA 94121
tel: 415/751-6306; fax: 415/221-5873
e-mail: ililabas@pacbell.net

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For more information, contact:
Matz Rubber Company, Inc.
1209 W Chestnut St., Burbank, CA 91506
tel: 818/840-8042; fax: 818/840-8340
website: www.matzrubber.com

PLEASE SEE MATZ RUBBER CO.'S AD, PAGE 47.

PROCESS ENGINEERS, INC.

Process Engineers, Inc., (PEI) has served the wine industry for over 40 years. PEI designs, manufactures, and installs systems for the complete spectrum of grape processing and packaging. PEI serves as a manufacturer's distributor to such companies as Waukesha Fluid Handling (pumps, etc.) and represents many other manufacturers and types of pumps, (centrifugal, positive displacement, and pneumatic). PEI's valves are the wine industry standard (ball, butterfly, divert, diaphragm). PEI also supplies controls (loop, PLC), stainless fittings, tube, hoses, and gaskets.

PEI is the leader in design and supply of automated pump-over systems using dedicated fixed-place pumps.

PEI has designed and built custom systems for automated pumping/patching, heat transfer (automated must, juice, wine heating and cooling), and CIP.

For many years, PEI provided major process equipment (destemmer/crushers, presses, filters, barrel washers, etc.) imported from Europe. PEI now offers American designed and built process equipment, utilizing standard and locally available parts.

PEI announces a newly formed strategic alliance with DEL Agricultural Ozone authorizing PEI as a direct distributor of DEL ozone equipment. This equipment will include, but not be limited to DEL's standard wine industry ozone machines — the AGW-0500 mobile ozone surface sanitizer and the AGW-1500 mobile recirculating ozone system.

For more information, contact:
Process Engineers, Inc.
26569 Corporate Ave., Hayward, CA 94545
tel: 800/972-0904; fax: 510/785-8187
e-mail: michael1pei@aol.com

PLEASE SEE PROCESS ENGINEERS' AD, PAGE 99.

MERCIER, USA.

As a direct representative of master cooper Frederick Mercier, Mercier U.S.A.'s goal is to link customers to his traditional, quality crafting.

Sales Manager, Krimo Souilah, has extensive experience with cellars and *terroirs* around the world, which allows his cooperage to understand and adjust to your wine-specific needs.

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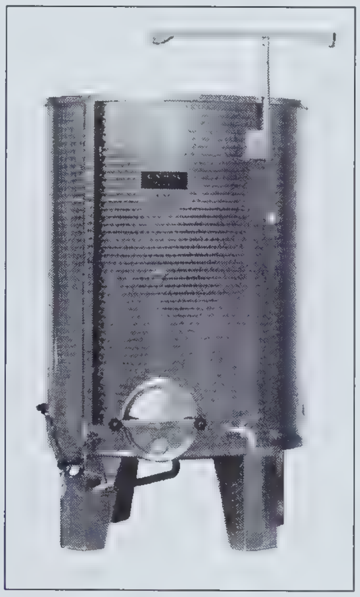
Mercier U.S.A., Inc.
Krimo Souliah
2164 Monticello Rd., Napa, CA 94558
tel: 707/251-5818; fax: 707/251-5811
e-mail: mercierusa@aol.com

PLEASE SEE MERCIER USA'S AD, PAGE 95.



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Established in 1980 and formerly known as Tonnellerie Francaise, Nadalie was the first French Cooperage in the U.S. to produce wine barrels from American oak. Nadalie crafts these barrels in the classic French-traditional style, tailored to enhance the unique qualities American oak brings to great wines.

NADALIE
USA

In addition to barrels produced in Calistoga, CA, Nadalie offers French oak barrels from a variety of forests from the Nadalie Bordeaux and Marsannay Burgundy cooperages. Nadalie also imports Intermedio, an assemblage of woods from Hungary, Lithuania, Romania, Russia, Slovakia, Slovenia, and the Ukraine.

Barrel sizes from 110L to 500L are available and all barrels are made to customer specifications.

New to this year's Nadalie USA sales team are: Thea Gilien who focuses on Napa and the Pacific Northwest, Mo Kapur who concentrates on Sonoma County, the Central Coast, and the Southwest, and veteran Tom Cottrell continues to represent Nadalie USA on the East Coast.

For more information, contact:
Nadalie USA
Duane Wall, Alain Poisson,
Thea Gilien, Mo Kapur, or Tom Cottrell
1401 Tubbs Lane, Calistoga, CA 94515
tel: 707/942-9301; fax: 707/942-5037
e-mail: nadalie@napanet.net

PLEASE SEE NADALIE USA'S AD, PAGE 25.

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So, if winemaking is all about confidence — it's all about control. The coopers at Tonnellerie Saury understand their craft and its importance to you. A barrel is a tool in your palette, and you choose a type of barrel as a perfect complement to your wines.

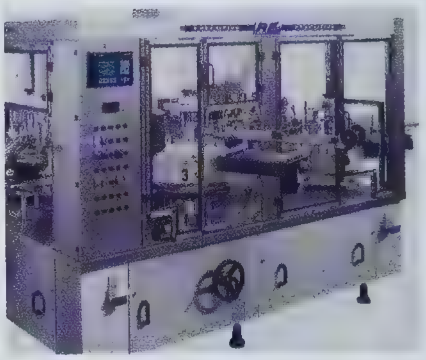
Tonnellerie Saury provides you with the option of either immersion-bent or fire-bent barrels, as well as French, American, and Eastern European oak — all tight-grain stave selections that are aged for 2½ years. Saury's rigorous standards provide you with a consistent tool to help you deal with the unpredictability of the vintage.

Let Tonnellerie Saury show you why so many winemakers use its barrels with confidence.

For more information, contact:
Tonnellerie de Correze, U.S.A.
Bayard Fox, U.S. representative
PO Box 672, Rutherford, CA. 94573
tel: 707/963-3666; fax: 707/963-8228
e-mail: saury@juno.com

PLEASE SEE TONNELLERIE SAURY'S AD, PAGE 69.

SCOTT LABORATORIES, INC.



Scott Laboratories introduces P.E. Labelers to its mix of equipment offered.

Every part of the manufacturing process is controlled by P.E. at its factory. To date, over 3,500 P.E. Labelers have been delivered to customers in 106 countries. Production speeds range from 25 BPM to more than 1,500 BPM. Both cold-glue and pressure-sensitive labelers are available as rotary or inline machines. P.E. has a quality labeler for every size winery.

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Other equipment available from Scott Laboratories for your winery needs are: VELO (filters, presses, fermentation tanks), WILLMES (presses), GAMAJET (tank & barrel cleaners), MANZINI (pumps), ARMBRUSTER(stemmer/-crushers, must pumps), GUTH (mixers, stands), and MBF (blowers, rinsers, fillers, corkers, cappers, conveyers plus line design and automation).

For more information, contact:
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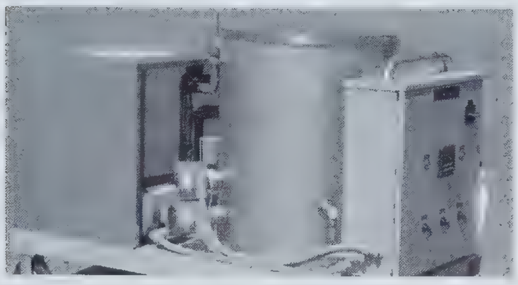
2220 Pine View Way, Petaluma, CA 94955
tel: 707/765-6666; fax: 707/765-6674
e-mail: info@scottlab.com
website: www.scottlab.com

PLEASE SEE SCOTT LABORATORIES' AD, PAGE 49.

REFRIGERATION TECHNOLOGY, INC.



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tel: 800/834-2232 or 707/987-0500
fax: 707/995-4792
e-mail: sales@rti2000.com
website: www.rti2000.com

PLEASE SEE REFRIGERATION TECHNOLOGY'S AD, PAGE 59.

CUESTA EQUIPMENT COMPANY

Cuesta Equipment was established in 1974 and became a California Corporation in 1980. The company has three business locations, serving the entire Central Coast of California. The San Luis Obispo store has 24,000 sq.ft.; the Santa Maria store has 10,000 sq.ft.; and the Paso Robles store has 10,000 sq.ft. of retail and warehouse space.

Cuesta takes pride in the depth, quantity, and quality of products and merchandise stocked in its three locations to serve customers. The business was founded on the premise of supplying customers with the complete package of tools, hardware, and materials required to perform their jobs in the best and most cost-effective manner.

Time is money, and Cuesta provides customers with all their job requirements in one stop. The customized catalog and the fabrication shop are just two key aspects that set Cuesta apart. Cuesta is very proud of its business but the staff realize their success is derived from you, the valued customer, and would like to take this opportunity to convey their thanks and gratitude.

For more information, contact:

Cuesta Equipment Company
4540 Broad St., San Luis Obispo, CA 93401
tel: 805/544-2540; fax: 805/544-2627
e-mail: cuestaequip@cuestaequipment.com
website: cuestaequipment.com

PLEASE SEE CUESTA EQUIPMENT'S AD, PAGE 31.

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Santa Rosa Stainless Steel (SRSS), one of the world's largest wine tank manufacturers, is in its 34th year of production.

SRSS builds tanks with capacities from one-gallon up to 400,000-gallon field-erected tanks. Each tank is finely crafted and passes through a rigid series of quality control checkpoints before shipment. Tanks are available on short notice from stock, or may be custom-built to winery specifications.

Cooling jackets or panels can easily be added to existing tanks. SRSS press-dimple jackets are quick to install in the field for retrofits to existing non-jacketed tanks or for increased efficiency.

Jobsite retrofitting and tank repair are a large part of SRSS's expertise. In 2001, SRSS released a state-of-the-art, automatic punch down unit that is installed into the tank and operated by an air cylinder on top of the tank. The automatic control system is manufactured by Green Controls of Cloverdale, CA. Five units were installed and operating at Carneros Creek Winery for 2001 crush.

For more information, contact:
Santa Rosa Stainless Steel
1400 Airport Blvd., or PO Box 518
Santa Rosa, CA 95402
tel: 707/544-7777; fax: 707/544-6316
e-mail: rod@srss.com
website: www.srss.com

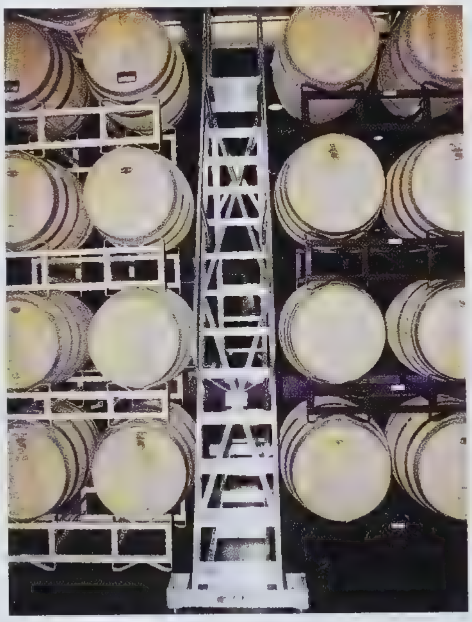
PLEASE SEE THE SRSS AD, PAGE 103.

STOKES LADDERS, INC.

A leading manufacturer of aluminum orchard ladders for over 36 years, Stokes Ladders, Inc., offers quality rolling barrel-room ladders specifically designed to fit in narrow aisles between stacks of wine barrels. Now used in over 60 West Coast wineries, these ladders provide workers safe access to barrels without having to climb racks, and also eliminate having to lower barrels with a forklift to be checked or topped.

Ladders can accommodate stacks from two barrels to six barrels high. Ladder heights, combined with their narrow 18-inch width, allow for maximum barrel count in the barrel room.

The ladders are constructed of high-strength, light-weight structural aluminum, and feature four heavy-duty, non-marking locking casters, a roomy 16-inch x 24-inch top platform with handrails and toe boards, 7½-inch deep steps, and a comfortable 60-degree climbing angle.



Options include a back ladder and different base configurations. Because of their narrow base, these ladders must only be used in the close confines of the barrel aisles. Custom ladders are available.

For more information, contact:
Stokes Ladders, Inc.
PO Box 445, Kelseyville, CA 95451
tel: 707/279-4306 or 800/842-7775
fax: 707/279-2232
e-mail: ladders@pacific.net

PLEASE SEE THE STOKES LADDERS, INC. AD, PAGE 85.

TONNELLERIE RADOUX U.S.A., INC.

The skills of Tonnellerie Radoux's master coopers are crucial to selecting the finest *haute futaie*-grown oak from forests maintained for hundreds of years under strict French regulations. Only the tightest-grained oak is selected from the Center of France, Vosges, and Central European areas and its American white oak is from Missouri, Minnesota, and the Appalachian region.

In 2002, barrels, puncheons, chips, and tank inserts are offered and Tonnellerie Radoux will proudly continue to create oak fermentation and aging tanks that were founder Robert Radoux's original focus.

Each barrel is produced to meet a wine's and winemaker's distinctive style and personalized service is reinforced by strict quality control to ensure consistency.

Just as the sun influences the maturity and flavor of grapes, the toasting process gives each barrel its aromatic qualities. Being accustomed to winemaker's styles and objectives is essential to achieve the appropriate balance between wine and wood.

The cooper's art requires an expertise and skill handed down from generation to generation. At Tonnellerie Radoux, commitment and pride in its work are a deep-rooted tradition that is passed down through training programs that teach apprentices the techniques that have withstood the test of time.

For more information, contact:
Tonnellerie Radoux U.S.A., Inc.
480 Aviation Blvd., Santa Rosa, CA 95403
tel: 707/284-2888; fax: 707/284-2894

PLEASE SEE TONNELLERIE RADOUX'S AD, PAGE 48.

THE BOSWELL COMPANY

Jean-Louis Bossuet at St. Simon de Bordes inspects logs for splitting.

With over 25 years of experience in the barrel business, the Boswell Company represents three French tonnelleries.

Jean-Louis Bossuet is a cooper/stave-splitter making Bordeaux barrels primarily for Merlot. Tonnellerie Berger (in Medoc) builds Bordeaux barrels for Cabernet Sauvignon, and Tonnellerie De Mercurey produces Burgundian barrels for Pinot Noir, Chardonnay, and Syrah.

These small cooperages craft French oak barrels without rushing. Oak sourcing, stave selection, and aging regimes are carefully controlled. Toasting processes are easily customized. Family management promotes consistency and accountability.

For 2002, the Boswell Company offers premium American oak barrels made in Bordeaux and Cognac for red wines. White oak for this project is selected from Staggemeyer Stave Co. in Minnesota. Raw, thin (25 mm) staves are cut, air-dried for 12 months, shipped to France, and restacked for an additional 12 months of outdoor seasoning.

In 2002, the Boswell Company's French specialists will cooper less than 1,000 thin stave American oak barrels.

The Boswell Company produces cellar tools for the wine industry including: domed and knurled silicone bungs, stainless steel stirring rods, Bulldog's Pup racking devices, foot valves, French glass wine thieves, and sponge rubber hose-cleaning balls.

For more information, contact:
The Boswell Company
1000 Fourth St., Ste. 640
San Rafael, CA 94901
tel: 415/457-3955; fax: 415/457-0304

PLEASE SEE THE BOSWELL CO.'S ADS, PAGES 57, 81.

fp PACKAGING, INC.

fp Packaging is the exclusive U.S. representative of Diemmes S.p.A's highly regarded line of grape processing equipment.

Diemme's AR TD (twin door) presses are available in 23-, 34-, 40-, and 50-hectoliter sizes. Each size TD press can be supplied in either an open-cage (slotted tank) or enclosed-tank configuration. All are PLC controlled and can include an onboard air compressor.

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FP PACKAGING

The Kappa line of destemmer/crushers includes the Kappa 15 and Kappa 90, giving throughputs from 10 to over 90 tons per hour.

Engineered to provide gentle handling, flexibility, and reliability, Kappas feature heavy duty construction, oversized drive components, and frequency inverter-controlled variable drive. Options include high-volume, progressive-capacity must pumps with available variable-frequency drive, and product-metering and pre-draining infeed augers.

For more information, contact:
fp Packaging, Inc.
562 Technology Way, Napa, CA 94558
tel: 707/258-3940; fax: 707/258-3949

PLEASE SEE FP PACKAGING'S ADS, PAGES 15, 37.

WORLD COOPERAGE

Still a great value, World Cooperage focuses on innovative processes and technology to provide consistent oak barrels from 24- and 30-month staves.

New at the cooperage are precision laser branding, stricter quality-control programs for monitoring toasting levels for consistency, and the checking of head diameters and chime thickness for exactness. New tooling and machinery not only ensure a constant shape and tight structure, but also perfect the barrel's appearance. These changes will preserve World Cooperage's reputation for being one of the best values in the cooperage industry.

Ninety years of experience in the oak business and the company's intensive oak maturation research with Dr. Jim Swan draw attention to alternatives in providing exact flavors from 24-month, fire-toasted chips, tank staves, oak powder, and barrel inserts. Sourced from the same fine, white oak as its barrels, World Cooperage's alternatives are available in French, Eastern European, Chestnut, and American oak.

For more information, contact:
World Cooperage
Barrels: **Ed Larmie, Yuri DeLeon, Jerry DeLorenzo, or Gary Kroll**
Alternatives: **Bill Munroe**
2557 Napa Valley Corporate Dr., Ste. D
Napa, CA 94558
tel: 707/255-5900; fax: 707/255-5952
e-mail: info@cooperage.com
website: www.cooperage.com

PLEASE SEE WORLD COOPERAGE'S ADS, PAGES 2, 80.

IMPROVEMENTS IN VINE IDENTIFICATION

BY Jack Heeger

Misidentification of vines is not a new problem in the wine industry. For many years in Europe, Chardonnay was called Pinot Chardonnay because it was believed to be a white version of Pinot Noir, for example.

In California, it has only been recently discovered that the "variety" Petite Sirah is actually a mix of at least three varieties including Durif, Peloursin, and true Syrah. Another California variety, Gamay Beaujolais, is actually just a clone of Pinot Noir.

Rootstock varieties are even more problematic, since many have the same species as parents and have strong similarities in appearance. As far back as the late 1800s, the need to assure the correct identity of vines gave rise to the highly specialized discipline of "ampelography" — the science of the identification of grape varieties.

The critical role that is played by ampelography in the wine industry became clear last year when a California grower filed suit against a nursery, charging it had sold him vines identified as Roussanne that were discovered to be Viognier when DNA tests were performed. The case attracted considerable attention because at least 10 other wineries bought similarly identified vines from the same nursery. Growers who purchased vines from other nurseries began to wonder whether they too might have purchased misidentified vines.

But even this dramatic case should not obscure the fact that misidentification of grape vines has become rare in recent years due to advances in ampelography.

French ampelographer Jean-Michel Boursiquot, acclaimed as one of the world's foremost vine experts, says that characteristics of Roussanne and Viognier are quite different to a knowledgeable eye. To have avoided the mix-up between the two varieties, any of the parties — the ultimate purchaser, the nursery operator, or the importer of the plant material from Europe — could have called in an ampelographer, who likely would have identified the vines properly.

Asked what purchasers can do to protect themselves against buying misidentified vines, Boursiquot responds, "Before you buy something new, you have to learn about it. From a general point of view, when you plant a new vineyard, the first (aspect of) quality control is to verify the cultivar identification and to check to be sure there is no blend."

Boursiquot is a professor at Ecole Nationale Superieure Agronomique de Montpellier in France, better known as AGRO Montpellier, considered by many to be one of the world's leading viticulture universities. He studied under Dr. Pierre Galet, generally regarded as the father of modern ampelography.

In the nearly 20 years since joining the faculty at Montpellier, Boursiquot has traveled to most of the world's wine growing regions, helping growers and universities identify vines in their vineyards and collections.

How does Boursiquot describe classical ampelography? "It's the visual recognition and statistical comparison of 80 descriptors that can characterize shoot tips, leaves, berries, and everything else about the vine. Most of the descriptors for cultivated varieties are in reference books, an important ampelographic resource, but practical experience in the vineyard with the individual vine types is still needed."

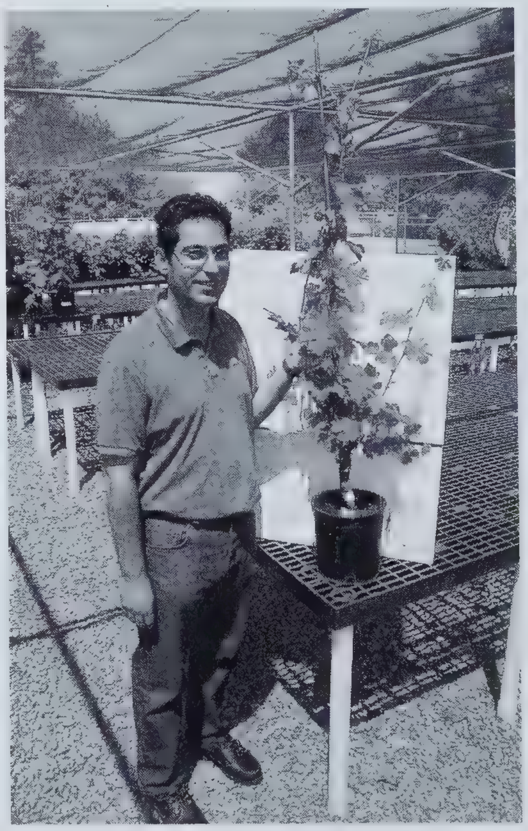
The identification process starts when someone provides a sample, either from a live vine or a dried specimen. It must be a minimum of one shoot with at least 10 adult leaves, but preferably with at least 30 leaves, in order to obtain sufficient data.

"We look at the characteristics (of the leaves). One or two (characteristics) can give some idea of what the variety might be. Then we compare the samples with our reference samples," he explains.

The process continues with other characteristics being examined and analyzed until the match is confirmed. For example, ampelographers might measure the length and angle of the leaves' veins, and then enter the data into a computer to obtain an average and compare the result with known standards.

The process may sound fairly simple, but consider that the Montpellier collection, which was started in 1876, contains some 7,000 specimens. There are 5,500 *Vitis vinifera* accessions, representing 3,000 cultivars, all taken from wine-growing areas throughout the world, plus 1,500 hybrids, rootstocks, and other species. (The collection also contains an herbarium with 10,000 samples of grape material that are used only for research.)

Every specimen and vine in the collection has been examined — with the 80 different descriptors noted — and then cataloged and entered into a computer



French ampelographer Jean-Michel Boursiquot.

database. Boursiquot believes it is the best true-to-type (corresponding to generally accepted reference) collection in the world.

Unfortunately for viticulturists around the world, the existing Montpellier database is not available on the Internet. "It's available only at Montpellier, but it's for anyone conducting research," notes Boursiquot.

Advances in computer technology have brought what Boursiquot calls the biggest recent changes to classical ampelography. "When I started (at Montpellier), we built a database using punch cards, and the computer was a huge machine that filled the room," he recalls. As computers have evolved, they have helped to combine the results of several different resources used in identification, including chemical analysis, isozyme analysis, and now DNA profiles.

Using chemical analysis, ampelographers obtain the profile of the plant from polyphenols in the skin of the berries. The presence or lack of a particular polyphenol can assist in identifying the material. Boursiquot says it's a good tool, but by itself isn't enough for positive identification.

Isozyme analysis involves examination of a young shoot tip, roots, and a woody cane. "These are stable in all plants," Boursiquot says. But this also has its drawbacks — each year the analysis must be made at the same time of the year, and it must be done immediately, because the samples are very fragile. Isozyme analysis works best on rootstock, because rootstocks are bred from a number of different species and have more chemical variation between them than most scion varieties.

In the late 1980s, DNA analysis made its debut in ampelography. "In the beginning it was difficult, because we had to use radioactive material," Boursiquot says. "But now advances have made it routine. To be efficient, DNA requires a large database."

Boursiquot calls DNA a "powerful tool" for ampelography. "You can use any part of the vine," he explains, adding that samples are best taken in the spring when the weather is not too hot. "If the tissue is young, it's easier to extract the DNA."

The analysis of variation in microsatellite markers, which are highly informative small regions of DNA is the most useful method developed to date. Analyzing these segments of grapevine DNA yields variety-specific profiles without any risk of contamination by DNA from other organisms.

But Boursiquot warns that, as effective as DNA has become in the identification process, the foundations of ampelography remain personal observation and the collection of materials, adding, "In my opinion, observation is always necessary to complete the identification process. Much of ampelography is seeing and remembering. You need to keep going into the field, you need to maintain the memory of what you see. You need to practice." He believes DNA analysis is just one more

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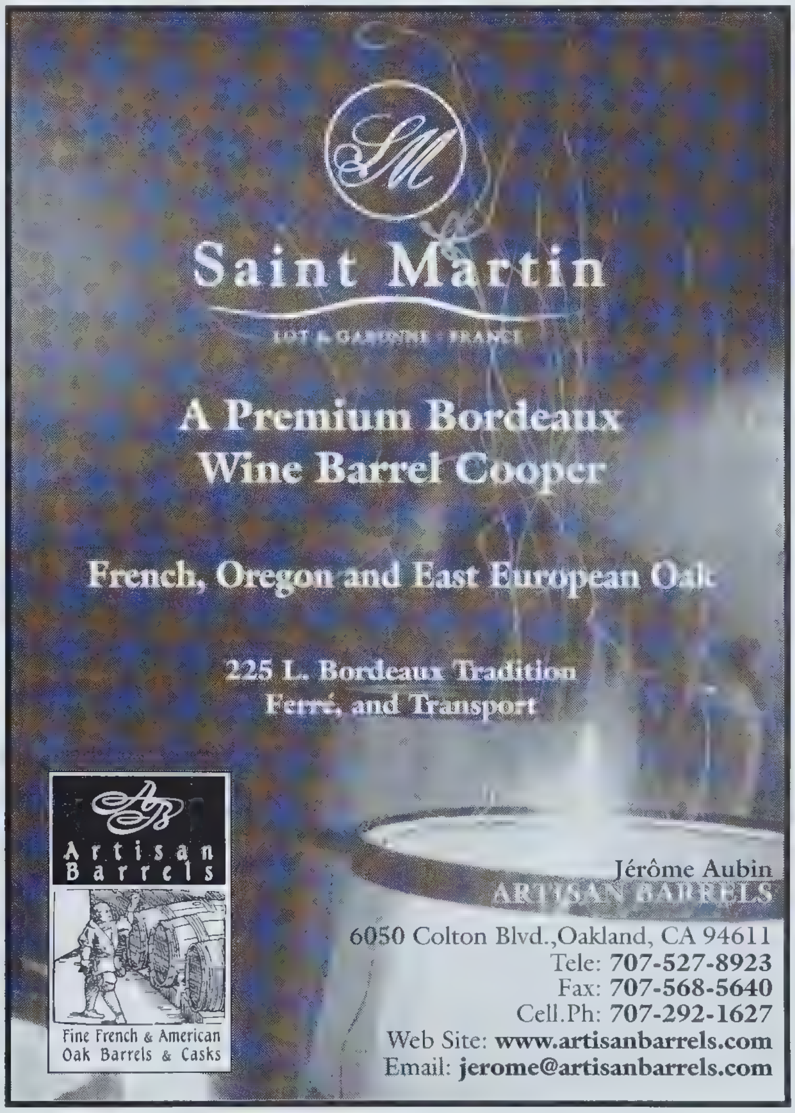

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tool that is used as a part of the discipline of ampelography.

A network of laboratories in 18 European universities and research institutes enables ampelographers at Montpellier to compare data. Boursiquot reports they are working on developing a set of microsatellite loci standards, "but it will be a few more years before we can get standards with a complete database."

As advanced as the science of ampelography is now, Boursiquot notes it is still impossible to identify individual clones of various cultivars. However, some positive results have been obtained and improving techniques for differentiation of clones remains high on his wish list.

According to Boursiquot, the easiest varietals to identify are Chardonnay and Cabernet Sauvignon. "It's because of the leaf structure," he says. "These are more stable, with less variation." On the other hand, Pinot Noir is more difficult to identify because "it contains considerable intravarietal (clonal) variation."

Boursiquot relates an incident that occurred while he visited Chile in 1994. "They showed me a vineyard and said it was Merlot. I told them it was not, that it was Carmenère." The Chilean vineyard owners weren't convinced, but subsequent DNA analysis proved he was correct. He says it demonstrates that when making an identification, it is necessary to provide more information: "If you say only that it is not Merlot, they won't believe you. If you say it is not Merlot, but it is Carmenère, they (are more likely to) believe you."

Fortunately, such misidentification can sometimes produce benefits as well as problems. In Chile, for example, Carmenère is now becoming the new desirable cultivar for Chile. In fact, it has become so popular in the international market that FPMS at UC Davis, using the DNA technology, searched old collections until a California selection of Carmenère was found.

Boursiquot has visited California four times, the first in 1990 and most recently for the academic year of 2000–2001, during which he has been on sabbatical with his family.

He has been working in the laboratory of Dr. Carole Meredith, Department of Viticulture & Enology (VEN), University of California, Davis. Their joint project is designed to identify the parentage of the "noble varieties." Some of this groundbreaking collaborative research has been published in the high profile journal *Science*.

Among the changes Boursiquot has observed during his visits over the last decade is a much greater sense of cooperation between winemakers and viticulturists in the New World, which reflects a similar spirit of cooperation he has witnessed among the world's ampelographers.

That observation is confirmed by Dr. Deborah Golino, director of Foundation Plant Materials Service (FPMS) at UC Davis. "In the past, the pools of expertise were not shared, but the international-

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ization of the wine industry changed this," she observes. "Ampelographers throughout the world now work together. They share information, they share collections. The level of the science of ampelography globally has been raised by the cooperative spirit of a new generation of scientists."

During Boursiquot's latest trip to California, he assisted FPMS with identifying its collection of 2,200 vines and 500 selections.

"His help has been invaluable to FPMS," says Susan Nelson-Kluk, the grape program manager. "In the mid-1980s a number of variety-naming problems emerged. Some were because unique variety names used in California were different than the names used for the same variety in Europe.

"Other problems were actual naming mistakes that needed to be untangled. This was difficult to do because there were few ampelographers and very limited local grape reference collections and ampelographers available to FPMS at the time. The UC Davis VEN Department helped by planting a comparison vineyard with selections suspected of being misidentified next to selections of more certain identity.

"At the recommendation of Dr. Michael Mullins, chairman of VEN in the late 1980s, we contacted Boursiquot and he came to FPMS for three weeks in 1990. He spent four hours in the vineyard and four hours in the office every day inspecting and reporting on the identity of over 4,000 total vines in the FPMS, VEN, and USDA clonal repository vineyards.

"His advice was key in making decisions about renaming a few selections, recognizing important synonyms used in other countries for some varieties, and confirming the variety identity for many selections. The FPMS collection was also checked by several other internationally recognized ampelographers throughout the 1990s, making it one of the best studied collections in the world."

When he's not traveling to the world's vineyards, Boursiquot works with the Montpellier collection and teaches ampelography there, as an important part of the university's viticulture program. He has a young assistant who fills the same role he played in his younger days with Galet.

Becoming an ampelographer is a long and arduous road. Under Boursiquot's tutelage, in one year students can learn to identify 10 species, 25 rootstocks, and 45 cultivars. They can also recognize most of the internationally-known varietals. They must know many aspects of viticulture, such as pathology, physiology, entomology, and management techniques, as well as ampelography. They spend considerable time in the classroom, in the field, and in the lab.

In the future, Boursiquot's graduates almost certainly will have the knowledge and skills to prevent situations like the aforementioned Roussanne/Viognier mix-up. ■

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Creating a regional Visitor center

Continued from page 42

small wineries that another tasting room is a good thing is sometimes difficult.

"In addition to the benefits of critical mass, they need to view the visitor center as another sales outlet, one that may well be open during hours that they're not. Over 60% of our visitors go on to visit and buy wine at area wineries, which proves we're enhancing their profit picture."

Another tip is to work out pricing of wine to the regional visitor center as far in advance as possible. Normally, wineries charge their tasting room the cost of producing the wine or something between that cost and FOB.

What is a fair price to charge a regional visitor center which is, after all, a promotional tool for your region? I think FOB is certainly fair. That's what a winery receives when they ship to a distributor, so why should they get wholesale when they ship to their regional promotional visitor center?

Another heads-up is wine selection. A worst-case scenario is contending with a powerful winery that has a lot of clout locally and whose representative on the board may talk the visitor center into taking product which does not reflect well on the region.

A solution for this potential problem is to employ the principle of arbitration. Everyone involved with the project — wineries as well as the regional visitor center board — has a voice in selecting an independent, agreed upon, expert to evaluate the wine proposed for use at the regional visitor center.

Opening party

I usually recommend that opening parties be a benefit for some local charity, because it shows that you are a good neighbor. Plus, you can get free volunteer labor from the charity. However, in the Lodi Center's case, this choice was not appropriate.

"Our Winegrape Commission funding is based on mandatory assessments from local growers. Since these dues had funded the construction of our visitor center, I didn't feel comfortable inviting our growers and then charging them $25 to $50 for a charity," he says. "We also needed to invite wine industry luminaries and VIP locals, such as the mayor and city council, so in the end, the party was expensive. The payback, of course, was immediate high visibility for our program."

Ongoing staffing and operations

Of course, you will need a manager and paid staff for the facility. However, consider supplemental volunteer staff as well. In interviewing volunteer staff at other facilities which weren't wine-oriented, I identified three things that

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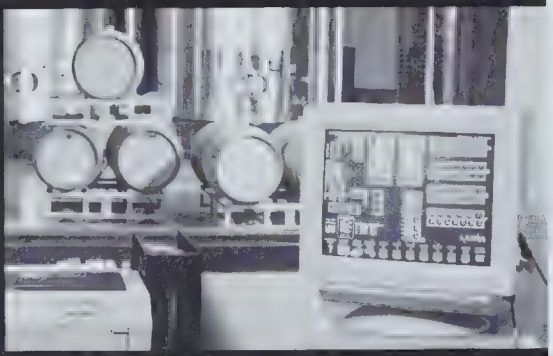

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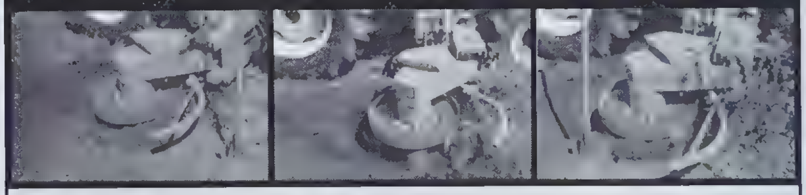

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Creating a regional Visitor center

Continued from page 92

were necessary to find and keep people who will work for free:

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3) A generous discount (50%) in the gift shop for volunteers.

Wine Club

Another important component of any tasting facility is a wine club. Club members are paying to be reminded about your wine and your region when they receive club shipments, and most clubs are extremely profitable.

Non-wine items

Non-wine items for sale at your center should also reflect your region. Use local vendors for logo apparel that promotes your region. Use local products, such as jams, dipping sauces, and locally produced art, which promote your particular region in a high quality way and put cash back into the community.

Additional revenue

Also remember that your facility can be rented out for functions and parties and result in another profit stream. (See March/April 2002 *PWV* for my next article with information on how to host profitable special events.)

Winery partners

Here is one scenario: Winery tasting rooms that wish to be sent business can become "partners" with the facility, and pay a fee of $100 to $300 per year for that privilege. In addition, they pledge to sell wine to the facility at FOB. These wineries would be featured prominently in recommendations and placement of brochures or other promotional literature.

Measuring success

One more tip is to develop a system to enable participating wineries to count visitors referred from your facility. For example, when visitors indicate they want to go to a specific winery, call the winery and provide personal description and then check later to confirm their visit. Or ask the visitor to mention that they received information about the winery tasting room from the regional information center and in return, they will obtain some special attention (whatever the winery can provide on short notice).

There are other ways to track visitor traffic, but it's important to use some viable system, so your "partners" know you are doing a good job for them. Also your compliance expert should be consulted to make sure your tracking system doesn't violate Alcoholic Beverage Commission rules.

Overview

You should look at this operation in terms of its benefit to your regional economy. As with most start-ups, tasting room profitability may come two years down the road. Keep in mind that it can take three to five years just to get the project up and running, plus another two to four years to achieve profitability.

However, the benefits to your region in terms of increased traffic at the wineries and food and lodging operations can be substantial. Moreover, don't overlook the biggest plus, which is increased awareness of wine quality from your region.

In the Lodi Wine and Visitor Center, there is a large wall of bottles displaying all the wines that use Lodi-Woodbridge grapes. This display is very impressive for the visitor, and it does an outstanding job of accomplishing the goal of the Lodi-Woodbridge Winegrape Commission to make consumers aware of the quality of the grapes and wine from the region. In the long-term, it also improves the price of the region's grapes. ■

"If any readers would like to consider this type of facility, I would be happy to talk with them," offers Mark Chandler, executive director of the Lodi-Woodbridge Winegrape Commission. "Because of my association with Wine Vision, I'm working on making wine more visible and friendly for the average consumer. So any interaction on this topic will be a important component of our mission. I can be reached at 209/367-4727, ext. 13."

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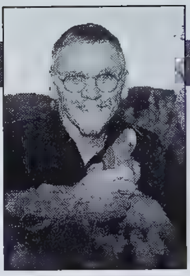

Spanish varieties: the next trend

Some producers are thinking about new grape varieties, and I suppose it has something to do with the current Chardonnay glut. I consider this is a good thing. I am a great believer in giving consumers more variety in their varieties.

I have yet to see any compelling evidence that Chardonnay and Cabernet Sauvignon make the world's greatest wines, despite their market dominance. There are other varieties around the world which, I think, make equally good wines, but which are not popular — yet. I am sure they will become so in the future.

Over the last several years, I have hosted seminars in Australia to alert the industry there to the prospects of new varieties. I have, on separate occasions, brought speakers and wines from Italy and Spain, to show to Australian producers. (In the future, I plan to do such seminars in California in association with California State Polytechnic University in San Luis Obispo).

Italian varieties are now quite well-known, and no longer in the "never heard of it" category. But what of Tempranillo and Graciano, two red varieties, and Albarino and Verdejo, two whites? You've probably never heard of these Spanish varieties, even though you would likely have heard of Grenache and Mourvèdre, two Spanish reds, and Palomino, a white. Perhaps you thought Grenache and Mourvèdre were French varieties? They are originally from Spain, known there as Garnacha and Monastrell, respectively.

Grapes and wine in Spain

The Spanish wine industry is the third largest in the world, but less well-known than the French and Italian ones. However, Spanish wines are well-known in Europe and the U.S. Sherries made from Palomino in the Jerez area are known world-wide for their unique character, but sadly, their appreciation is on the wane.

Red wines from the northern Rioja region produced from Tempranillo and other varieties are well appreciated in Europe. There are also new trendy regions such the Ribera del Duero northeast of Madrid, famous for blends of Tempranillo and Cabernet Sauvignon. To the east and towards the Mediterranean coast is the Priorato region, which makes what is likely the world's best Grenache wines from very stressed, low-yielding vines grown on terraces. I always thought Grenache made less well-colored and flavored wines than other varieties until I tried these.

Likely adaptation to America

Most of Spain has a warm-to-hot, summer-dry climate, like California and much of Australia. For these reasons there are likely good opportunities to expand the use of Spanish varieties in many parts of California and other western states.

The northwest corner of Spain has summer rainfall in the cooler Galicia region, and here the spectacular white variety Albarino (or Alvarino) produces its remarkable wines. Looking for an emerging cool climate variety that can withstand rainfall? Look no further than Albarino, which is quickly achieving "cult" status in the U.K. wine market.

In fact, we can be even more precise about which places Spanish varieties can be grown. For Tempranillo, I have looked for places in the U.S., which most closely match the regions of distinction in Spain. (Details about this approach can be found at www.smartvit.com.) We used climate data from three subregions of the Rioja: the Haro region, the highest and coolest; the Rincon de Soto at lower elevation and warmer; and the Agancillo, which is intermediate. The more distinctive wines come from the cooler, elevated Haro region.

The following results are based on temperature only, since it is the most important aspect of climate influencing phenology, wine style and quality. Our sophisticated computer techniques correlate separately the maximum and minimum curves, rather than relying on averages as the Heat Degree Days method does, which produces well-known flaws.

Where are the best homoclimes (places with a similar climate) of Rioja in the U.S.? For the more elegant styles of Rioja Alto, the answer is in Oregon, with climate-recording stations such as Portland, Eugene, Silverton, North Willamette, and Lookout Point being very similar. In fact, these were generally the closest matches to Rioja we found in all the U.S. There were some matches in California, though not so close. These were mainly in the eastern part of the state, including Mt. Wilson, Lake Arrowhead, and Mt. Hamilton.

The warmer parts of Rioja at Agancillo had more homoclimes in California: at Salt Springs, Angwin, Sandberg, and Mt. Palomar. There were also matches to maximum summer temperatures in Ohio, New Jersey, and Illinois, but minimum temperatures are lower there.

The warmest part of Rioja at Rincon de Soto shows Californian matches in Mt. Palomar, Sandberg, Salt Springs, and Petaluma. Matches for summer maximum temperatures are shown for several places in New Jersey and New York.

To further refine site selection, follow-up analysis could be done for rainfall and rain days, humidity, and sunshine. However, the temperature data give a very good indication of suitable regions for Tempranillo, and an idea of wine style. Interestingly, a few place names on our list are not now planted to grapes. Perhaps someone could buy potential vineyard land at low prices!

About Spanish varieties

Since Grenache and Mourvèdre are well-known now, I will focus my remarks on some varieties that are not.

Tempranillo

Jancis Robinson's book *Guide to Wine Grapes* rightly gives due acknowledgement to the wonderful variety Tempranillo, probably "the king of Spain." It is a variety with large bunches and is prone to overcropping. It has a good sounding name, which is important for marketing, and can be grown in a wide range of climates, as can Syrah. In fact the wine is a similar style to Syrah, soft and round. It is a good blending variety. The variety had the misnomer Valdepenas in California for many years. There is marked clonal variability.

Tempranillo has late budburst but early harvest. It has large leaves and is somewhat droopy, making it suitable to vertical canopy positioning (VSP). The first vines trained to Smart-Dyson in Rioja are showing improved wine quality over the VSP used previously. The variety can yield well, but cluster thinning is desirable for best wine quality.

My Spanish friend Joaquin Galvez emphasizes that the best wines come from vines with the smallest berries. As with Syrah, this is likely not because small berries in themselves make better wine, but the factors that cause small berries also cause better wine quality.

Graciano

This is a lesser-known red variety from Rioja, as it is typically blended with Tempranillo. It shows late harvest, and clusters are relatively loose. The vine is quite resistant to powdery mildew. The variety adds "grace" (acidity) to Tempranillo. Although the wine is rarely found by itself, I have seen excellent varietal wines of Graciano in Rioja and Australia. This variety is well worth planting for evaluation.

Albarino

If Tempranillo is the king of Spain, then this white variety is surely the queen. It requires a cooler climate, but interestingly in Spain there seems little experience of growing it in many regions. In its home region of Galicia, Albarino produces floral wines with intense nose and flavor. These characters are described as peachy or grapefruit. It is a winemaker's dream, not requiring wood and being suited for early marketing, like Sauvignon Blanc.

Verdejo

Not to be confused with Verdelho, Verdejo can be grown in warmer regions. It is principally found in the Rueda region in north-central Spain. It is low-yielding, but the wine is excellent. It is aromatic, almost herbaceous, and blends very well with Sauvignon Blanc, which is also grown in this region. Bud break and harvest are average, with average vigor. Cluster size is small, and the vines are susceptible to powdery mildew.

Conclusions

Who will pick up the Spanish varieties and become their undisputed proponent, becoming known as the wine world's "Don Quixote of America"? I think America's finest Tempranillo wines will come from Oregon. We need to wait about 20 years to see whether my prediction comes true. ■

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by Sue Weeks

LABORATORY DESIGN

Doing it right: Case study of St. Francis Winery

St. Francis Winery, nestled against the Mayacamas Mountains in Sonoma County, produces 250,000 cases of wine per year. In 1997, the decision was made to build a new winery facility including a good quality small to mid-size laboratory.

The laboratory needed to accommodate most routine tests including, pH, titratable acidity, free and total sulfur dioxide, volatile acidity, enzyme and colorimetric assays, stability tests, and microbiological analysis. It also had to be serviceable and large enough for a projected increase in production. The laboratory was completed in January of 2000.

How did St Francis meet the challenge?

John Speed (QC director), Lori Knapp (associate winemaker), and their team took a well-ordered approach. First, they visited other winery laboratories to identify what features to incorporate into the new lab. This also gave them a chance to talk to lab personnel to determine what worked and what they would have done differently if given another opportunity.

This consultative process is a key element in the success of any laboratory project, and the staff of St. Francis took it very seriously. The result is an attractive, well thought-out facility that will accommodate increasing production levels and serve the winery well for many years.

An important consideration for the design was calculating the cost of the products and services the winery had been purchasing. As a small winery, it didn't make sense to have a water purification system or to prepare and standardize reagents.

However, the new lab had to fit the needs of a larger winery, so it turned out to be more cost-effective to do many things in-house rather than paying for outside services. Other things, such as a gas chromatograph for alcohols, were originally part of the plan but turned out not to be cost-effective. One of the most important elements of the design was envisioning how the laboratory would need to operate in five or 10 years, and to accommodate those needs.

The laboratory occupies approximately 1,000 square feet, which is separated into a large laboratory and a small microbiology room.

The first thing that is noticeable when you enter the laboratory is an abundance of natural light. The design incorporates a huge skylight that runs the length of the laboratory, and numerous windows along the two outside walls. The windows are placed so as not to interfere with equipment location, and to optimize the outlook from the laboratory.

There are three external doors, one leading outside and two leading to cellar areas. The lab was placed in a central location, with direct access to the cellar, winemaking offices, and general offices. This has turned out to be a big plus because it has allowed the laboratory to be used for impromptu conferences and for review of analysis or sensory evaluation.

Having a comfortable space with enough room for people to stop in and chat has helped to foster communication among staff members. Maintaining that communication has been one of the biggest challenges in the transition from a small to medium-sized winery.

The laboratory has many features which are the product of thoughtful design:

Benches

Each bench incorporates all the utilities (*i.e.* natural gas, nitrogen, water, and electricity) required by common laboratory equipment, allowing maximum flexibility for equipment placement. The utilities also include access to vacuum piped in from a pump, which is housed outside, minimizing any disruptive noise inside the laboratory.

Each bench includes a sloped channel sink running along its length. This six-inch deep, six-inch wide stainless steel channel slopes gently into a conventional laboratory sink where it feeds to waste. This channel allows the neat disposal of wastewater and samples at any point on the bench, without the need for the unsightly confusion of plastic tubing.

Another useful feature of the lab design is having one bench top with no permanent equipment. It has worked out well to have a space that can be used for different tasks during the year, such as enzymatic assays, bottling QC, color and tannin assays,

Sloped, channel sink allows for easy disposal of liquids.

Skylights run the length of the lab.

fining trials, etc. It also allows for preparing reagents as needed, and can be used as planning space by lab or production personnel, so results can be reviewed and informed decisions made.

One wall of the laboratory houses glass-fronted storage cupboards, so all glassware and reagents can be seen at a glance, and the floor is tiled in practical non-slip ceramic tiles. There is also an "explosion proof" refrigerator for storing reactive chemicals.

Microbiological facility

The laboratory boasts a separate micro room, complete with a space-saving plexiglas mini-hood, autoclave, incubator, and microscope. This facility is very useful for monitoring performance of the in-house bottling line.

Administration

The laboratory has a spacious administration area adjacent to the micro room. This is set at desk-bench height, housing the computer, phone, and fax facilities, and shelving for laboratory catalogues and other information. There is space to store staff personal effects, protective clothing, and equipment.

Natural gas, nitrogen and chilled water are plumbed to all lab benches.

Microbiology room has one reverse osmosis water filter and a nanopure water filter on autoclave, plexiglass hood, and microscope.

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The St. Francis laboratory is the product of careful planning and thoughtful design. The result of this process is a well-planned, functional laboratory that will meet the needs of an expanding winery for many years to come.

Acknowledgement

The author acknowledges the assistance of the team at St. Francis Winery in preparation of this column. Special thanks to Sally Johnson, director of quality control, for providing additional information after my visit.

Sue Weeks is an Australian wine laboratory consultant. She provides assistance in areas of formal or informal quality system implementation, method validation and troubleshooting, laboratory setup, personnel selection, and staff training. She also facilitates international wine industry training in conjunction with the Communicating for Agricultural Exchange Program (CAEP). She visits America often and can be contacted through the Bibber International website at www.bibber.com.au or tel: 61 8-8563-2422 or fax: 61 8-8563-2433. She can also be contacted through Gordon Burns at ETS Laboratories at tel: 707/963-4806.

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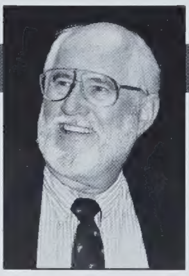

by D.R. Storm, PhD. P.E.

FRENCH INNOVATIONS IN TRAVEL AND GARBAGE

There always seems to be a formidable logic to the French solutions for management of transportation and public utilities (except maybe telecommunications). For some reason, these creative ideas have escaped the attention of planners and engineers in the rest of the world.

Across France, the north-south and east-west networks of toll roads carry French, German, Italian, and Spanish (the EU team) commercial truck traffic and private autos with the ease that is only possible with nearly flawless road surfaces and strategically located rest stops and refueling centers. Small and mid-size autos are the norm, with a few BMWs and Mercedes sprinkled in to prove that a 150 km/hr (~90 mph) speed is possible in the fast lane.

The high speed train system (TGV) whisks passengers in comfort and style on seamless tracks that take the clickety-clack out of railroad travel. Pet dogs (other animals are possibly permitted aboard, but I did not observe any) are restrained only modestly and seem to enjoy the camaraderie that strangers on a train produce. Periodic worker strikes seem to be the only variable that is out of control of the system administrators.

Solid waste collection has a French twist that, at least superficially, makes it appear superior to the U.S. practice of having trucks service residential containers weekly at curbside.

The French approach is to have consolidated containers located at reasonable walking distances from a given cluster of homes or apartment complexes. Not only do Jacques or Fransois get to take out the waste, as Jack or Frank do in the U.S., but they also get the health benefits of a short walk and the chance to meet and talk to neighbors performing the same task.

Recycling of paper and plastic is also accomplished at the same pickup locations, but glass (wine, soft drink, and other containers) is usually delivered to a "cave" (French for "wine-producing co-op").

The reduction in pick-up stops with the consolidated waste depository approach saves time (labor) and vehicle fuel costs, and permits accumulated waste pick-ups semi-weekly thus depriving flies and other nuisance insects from a vintage waste that is at least one week old.

Aluminum and plastic container segregation bins have a simple but effective anti-freelance-recycler-for-francs design that would foil all except a thief armed with a chainsaw or oxy-acetylene cutting torch.

Aesthetics of the local pick-up stations have not been overlooked by the French. "Environmental" green containers and a tasteful, sturdy perimeter wooden rail fence keep the containers in place and prevent mischievous children from launching them down the street, all of which adds to the merit of a thoughtful design.

Disinfection without chemicals

PART I

Overview

The use of ultraviolet (UV) light for denaturing pathogens is a relatively new concept (ca 1940), although 19th century physicists and biochemists recognized the destructive power that UV light had on microorganisms.[1]

What was not controllable was the consistent generation of UV radiation in its most devastating form to microbes, *i.e.* at a wavelength of 254 nanometers. Not only is the 254 nanometer UV wavelength required for effective organism neutralization, but the intensity (flux) of electromagnetic energy must be sufficient to eliminate the full spectrum of potential waterborne pathogens.

Hanging washed clothing and linen to dry in the sun is practiced not only for the solar heating that removes moisture, but for the range of UV light that works its magic on nuisance organisms that may still adhere to the fabric.

For Third World countries that still lack the minimum standard of living that would permit clothes washing with hot water and disinfectants like chlorine-based bleaches, solar radiation and boiling are the only source of germicidal technology available to them.

Solar drying of fruits (raisins included) and vegetables also was practiced by many ancient cultures who achieved preservation of products from solar dessication and some additional degree of sterilization from the widely scattered UV wavelengths. No science required — it worked, so they did it.

What it takes to zap a germ

You might remember from your high school physics or university/college level science that the electromagnetic spectrum is composed of two bandwidths:

narrow = visible light waves
very long and
very short wavelength = invisible waves
(radio, infrared, ultraviolet, x-rays, gamma rays and cosmic rays)

As suggested above, a certain intensity of UV radiation is required for organism deactivation. It is now technically possible to create a UV reactor that is basically a mercury vapor lamp. An electric arc struck through a tube containing low pressure mercury vapor will produce UV in wavelengths of approximately 253.7 nanometers. The "theoretical" UV intensity required is as follows: [1,2]

	Bacteria virus and yeast * Wsec/cm^2	**Giardia and cryptosporidium** * Wsec/cm^2
Manufacturer's recommendations	30,000	30,000
Theoretical	10,000	30,000
U.S. Dept. of HEW	16,000	16,000
American National Standards Institute (ANSI)	38,000	38,000
National Sanitation Foundation (NSF)	38,000	38,000

*microwatts seconds per square centimeter

Why is there is no consensus of opinion on what degree of UV energy is required to deactivate all potential pathogens?

Because there is a conservative factor of safety that should prevail to buffer unanticipated equipment fluctuations in radiation and intensity. The manufacturer's warranty recommends that even at the 50% limit of bulb life, the unit could still be producing the suggested U.S. HEW minimum intensity of 16,000 Wsec/cm.[2,3]

Another operating variable is the transmissivity (transparency) of the water; clear groundwater, 96% and deionized (demineralized) water, 99%. Thus, if raw surface water is to be disinfected, turbidity caused by suspended sediment or color from decaying organic matter could reduce effectiveness of the UV system. Pre-filtration with conventional treatment (flocculation, coagulation, sedimentation and filtration) or a modification thereof would be required as a companion system to the ultraviolet unit.

The quartz sleeve, which is a principal element of all UV reactors that prevents direct contact of the bulb with the water, can become fouled with minerals (typically calcium, iron, sulfites, and nitrites). Smaller units come equipped with a manual wiper that cleans but does not scratch the quartz sleeve.[3] ■

**Part II of this two-part series will cover other aspects of UV disinfection including:

- monitoring, instrumentation and alarms
- capital and operating cost comparison to ozone and chlorine systems
- some advantages and disadvantages of UV systems.

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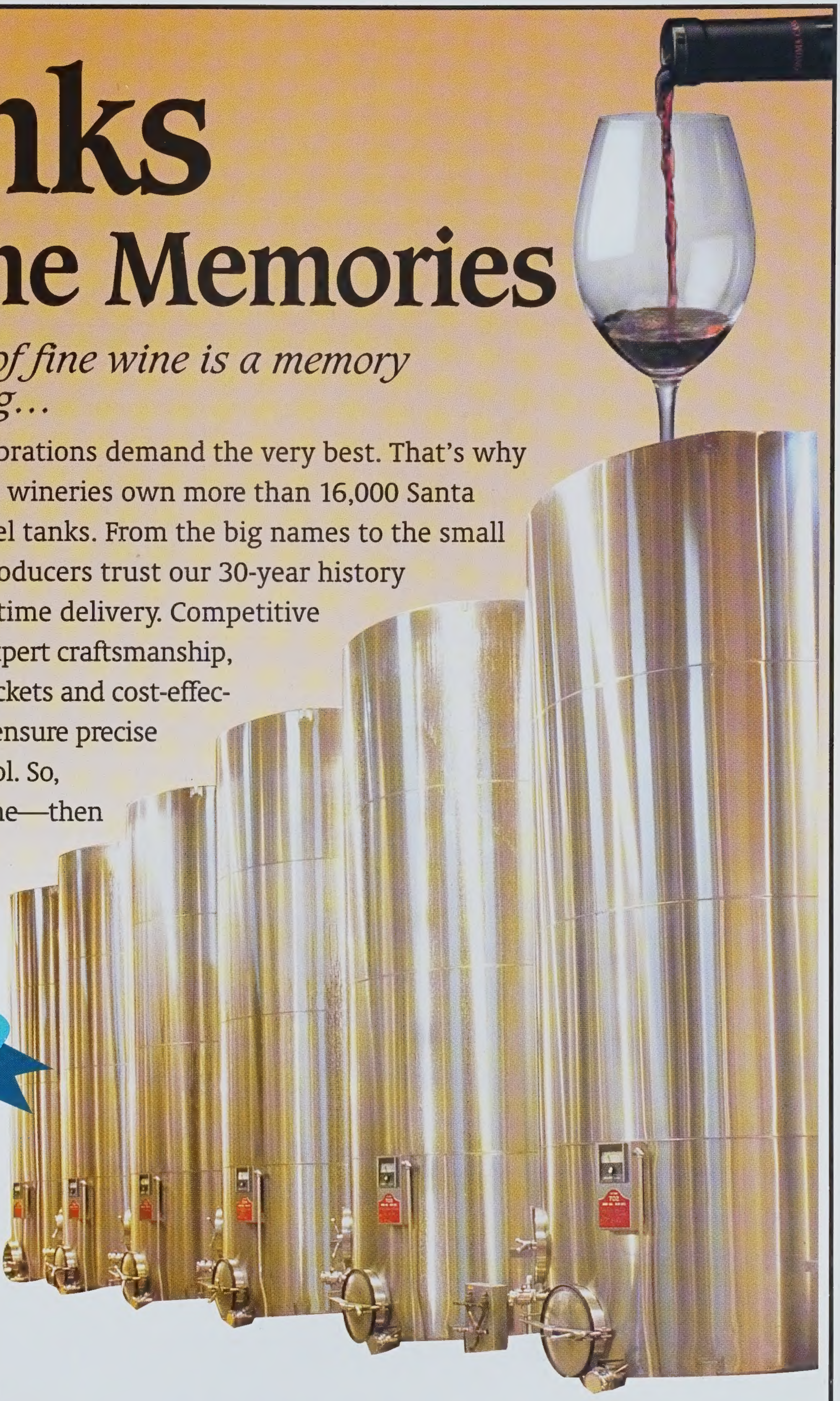

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